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Science and Democracy

A MANIFESTO on the relation of science to present developments in the international political situation has been issued on behalf of American men of science by a committee, of which Prof. Franz Boas of Columbia University, the doyen of American anthropologists, is the protagonist. It is a document which is no less remarkable for the extent and character of the support it receives, in view of conditions in the United States, than for its argument. It is signed by 1,284 scientific workers, including three Nobel Prize winners, Prof. Harold C. Urey of Columbia University, Prof. R. A. Millikan of the California Institute of Technology, and Dr. Irving Langmuir of the General Electric Company, Schenectady, N.Y. The signatories are drawn from a hundred and sixty-seven universities and research institutes, and include eighty-five college presidents, deans, and directors of industrial laboratories and experimental stations; sixty-four are members of the National Academy of Sciences.

The signatories call upon their colleagues to participate actively in the defence of democracy as the sole means of preserving intellectual freedom and insuring scientific progress. It is perhaps unnecessary to recall that, as the oldest and the greatest of existing democracies, the people of the United States cherish as their proudest and dearest political possessions the right of free thought, the right of free speech, and the rule of the majority. These are for them, as they have been for all free peoples (at least of modern times) the fundamental conditions of truth and justice, and as such the basis of free and democratic institutions. The aim of the manifesto is, broadly speaking, to demonstrate, and to urge upon all scientific workers the duty of showing to the people of the United States that the development of political theory and practice in the totalitarian States cuts at the root of these principles, and at the same time at the freedom of all mankind, as well as endangers the possibility of the advancement of man's well-being through the ministrations of science.

In demonstrating the relation of science to freedom of thought and speech under democratic institutions, the manifesto takes its stand on the recent resolution of the American Association for the Advancement of Science. "Science", it was there said, "is wholly independent of national boundaries and races and creeds and can flourish only when there is peace and intellectual freedom." "If science", the manifesto goes on to say, "is to continue to advance and spread more abundantly its benefits to all mankind, then the man of science has a moral obligation to fulfil. He must educate the people against the acceptance of all false and unscientific doctrines which appear before them in the guise of science, regardless of their origin."

Further, the Fascist position towards science is publicly condemned. It is shown to have violated both truth and justice in the most profound sense by the imposition of scientific theories and doctrines which have been demonstrated time and again to be false, and by debarring a section of the population, Jews or 'non-Aryans', from intellectual and scientific activity; while the "thousands of teachers and scientists who have been exiled . . . bear testimony to the incompatibility of Fascism and science". The manifesto in this connexion goes even further and regards "the attack on freedom of thought in one sphere, even as non-political a sphere as theoretical physics, as in effect an attack on democracy itself. When men like James Franck, Albert Einstein or Thomas Mann may no longer continue their work, whether the reason is race, creed, or belief, all mankind suffers the

loss"; and it concludes, "If we American scientists wish to avoid a similar fate, if we wish to see the world continue to progress and prosper, we must bend our efforts to that end now."

The action of American men of science in issuing this manifesto on the relation of development in the international situation to the progress of science has fallen at a singularly opportune moment; and its implications will not escape the notice of their colleagues in the countries of Europe. Unquestionably it has been to the advantage of the intellectual advancement of the world at large that, while in the political sphere the United States of America has held fast to isolation as a corollary of the Monroe Doctrine—a policy now for the second time within the present century under public consideration in view of danger to democratic institutions—that isolation has not been a characteristic of this great people in matters of the spirit, more especially in the development of the arts and in science. By free exchange and interchange of ideas and personnel, the New World has co-operated with the Old to their mutual benefit; while the recent approach of the American Association for the Advancement of Science to the British Association, for the promotion of joint consideration and discussion of problems of scientific import and socio-economic application, opens up further prospects of an accelerated movement towards world unity in attack on those broader questions in which science touches the interests and well-being of mankind as a whole. Notwithstanding differences in social conditions between the United States and the countries of the Old World, which would militate against either the utility, or perhaps even the possibility, of like action in the very different circumstances prevailing in the European democracies, nevertheless the pronouncement of American men of science inculcates a principle in its statement of the relation of scientific progress and democratic institutions, which may well be laid to heart; and it is of no less importance that once more it has demonstrated in practical form the essential solidarity of the world of science.

The Census and the Distribution of Population

EVERY civilized community needs a full and accurate knowledge of its human resources; and hence the census has developed far beyond its primary function of merely numbering the people. It has become a periodic stocktaking; and among other aims it should provide precise and full information about the distribution of the people within a country.

Every person is counted at the place in which he, or she, is at the date of the census. This gives the first facts of the distribution, what is called the *de facto* population of each census district and of the country. In the past this has been considered sufficient, provided that the actual census could be carried out within a very short time, so short that no appreciable movements took place during the count. Up to 1921, it was the only distribution directly recorded by the census in Great Britain. But in that year the count was made in June, instead of in April as usual; and the holiday movements which had then begun caused serious uncertainties in the results as compared with those of other censuses and with intercensal estimates. Hence in 1931 there was introduced a question requiring each person to state his usual, or legal, place of residence. This made it possible to count the regular inhabitants of each district, and so to measure the *de jure* population, by excluding visitors and including temporary absentees, a second stage in an accurate measure of distribution. The difference between the *de facto* and the *de jure* populations may at some places and times be considerable, especially in a holiday resort such as Blackpool; and it is obviously necessary to know the numbers of the resident population for many purposes of administration. The counting of the *de jure* population has always been the aim of censuses taken to determine electoral constituencies, as in the United States of America; it is surprising that it did not come earlier in Great Britain.

The requirement that each person shall state his place of birth enables the census to obtain some information regarding the origins and migrations of the people it enumerates. It is regrettable that the separation of Eire from the United Kingdom in 1922 has been allowed to interrupt the continuity of the records under this head. This can be avoided for the future if under 'birthplace' in the schedule we write 'British Isles' in place of 'United Kingdom'; and so obtain records

comparable with those of censuses before 1922, without losing anything in comparisons with that of 1931. A large part of the recent immigration into Great Britain is from Ireland; and fuller information about these immigrants is much to be desired.

In relation to the birthplace question, however, the chief desideratum is a fuller analysis and tabulation of the results. In 1931, for each administrative county and every town in England and Wales with more than 50,000 inhabitants, the census tables classed the numbers of those enumerated there into those born in that district, those born elsewhere in England, elsewhere in Wales, in Scotland, in Northern Ireland, or in any one of many other countries. But if the classification is to give information about migrations within England, 'elsewhere in England' is a useless grouping. To measure the 'drift to the south' it should be replaced by at least the county of birth of each person enumerated, for the whole of Great Britain or, preferably, for the British Isles. Also these migrants should be classified by age and sex, and perhaps also by occupations, so as to give a measure of the character of the migration. It is clear that to do this will involve much more detailed analysis and tabulation of the results. But the magnitude of the internal movements of our population has been so great in recent years, and its results are of such importance, as to justify a demand for the fuller and more precise knowledge of it which can only be obtained in this way.

Another important group of population movements is that of the daily journeys between residence and workplace. We all know that the day and night populations of many districts differ widely; but this knowledge is rarely precise. In 1921 the census schedule included a question on workplace, the answers to which gave valuable information on this daily ebb and flow of a large part of our population. The question was omitted in 1931; and only partly replaced by the requirement that each employee should state the address of his employer, which is usually the place at which he works. Thus, for 1931, this information is available for only a part of the population. The question should be restored for 1941, and applied to every person engaged in regular work. The importance of a knowledge of this daily movement for the planning of suburban transport, of roads, and of housing, and for other local government purposes, is quite obvious and sufficient to justify the cost involved in obtaining and tabulating the information.

Recent changes in the distribution of the population in Great Britain have been considerable. The 'drift to the south' (actually towards London and some parts of the Midlands), though it may have been exaggerated and misunderstood in the popular imagination, is a real and important fact. Such migrations, among a people whose numbers are no longer increasing to any considerable extent, involve actual decreases in the population of some other parts of the country. Before we can know the real importance of these movements or take any reasoned steps to deal with them, it is essential to have much more exact knowledge of their extent and range. In what numbers and in what proportions do the migrants come from the distressed areas, from highland areas, or from the rural areas and small towns? Do they spread themselves widely, or do they tend to move and settle in groups? There is urgent need for trustworthy answers to these and other questions concerning the migration; and a fuller analysis of the census returns can provide much material for the answers.

In England the census has provided from time to time, but never for all at the same time, information concerning four groups of facts relating to the distribution of the people. The first of these is the number of the *de facto* population of each census district at the time the census is taken. The second, begun only in 1931, is that of the *de jure* population, at its usual residence, for the same date. The third comes from the comparison of the first, or in future of the second, with the information as to birthplace, age, sex, and occupation; it gives a measure, necessarily incomplete but nevertheless of real value, of internal migrations and of immigration. The fourth group of facts relates to the daily, or other short-period, movements.

The importance of a knowledge of all these facts of distribution has been emphasized recently by considerations of air raid precautions and of civilian defence. A thorough knowledge of the normal distribution of the people is necessary for efficient defence in war, and not less so for any adequate national planning for times of peace. It is, therefore, very desirable that the coming census of 1941 should be used to obtain the fullest possible information about all four groups of facts relevant to the distribution of the population of Great Britain.

Ancient Hindu Algebra

History of Hindu Mathematics: a Source Book. Part 2: Algebra. By Bibhutibhusan Datta and Avadhesh Narayan Singh. Pp. xvi + 314. (Lahore: Motilal Banarsi Das, 1938.) 7.8 rupees; 13*s*.

THIS is the second volume of the three in which the authors are writing the history of Hindu mathematics. The first contained Part 1, dealing with numeral notation and arithmetic, which was issued in 1935, and noticed in NATURE of January 18, 1936, p. 88; the present volume (Part 2) contains the history of algebra.

Historians of mathematics have hitherto been handicapped in describing the course of development of Indian mathematics because they have generally been dependent upon a few special studies such as H. T. Colebrooke's "Algebra with Arithmetic and Mensuration from the Sanscrit of Brahmagupta and Bhaskara" (1817) and new editions of that work, "Notes on Indian Mathematics" of various dates by G. R. Kaye, a study by the same scholar of the Bakhshālī manuscript, and a few original texts and German or English translations, mostly brought out in India and so not generally accessible. But the published material is small compared with the extent of the sources. The editors' bibliography in Part 1 contains some thirty-eight items setting out the various books and MSS. to which they have had recourse, and from which they have translated in full a vast number of passages. They estimate that about half the content of this second volume is here presented for the first time, so that the future historian will have at his disposal copious material as never before.

The volumes are definitely source-books, and in consequence by no means easy reading. One characteristic of the Indian mathematicians is the careful formulation, *in extenso*, of *rules* for the solution of every type of algebraical problem (whereas the remains of the ancient Egyptian and Babylonian mathematics contain a multitude of examples, but practically no expressed rules). The rules have all to be expressed in words because the Indian had practically no symbols; the unknown was "yāvat-tāvat" or "avyakta", and was denoted sometimes by a blank with the number representing the coefficient following it, sometimes by abbreviations for the names of various colours, sometimes by letters of the alphabet; signs for operations were limited to + (after the symbol to which it relates), or a superposed dot or small circle, for minus, the others being abbreviations for words; powers were 'square', 'cube', 'square-square', 'square-cube', 'cube-cube', so that the Indian symbolism had not even in Bhāskara II's time (twelfth century A.D.) advanced beyond the stage represented by Diophantus (third century). It is not surprising, therefore, that the statement of a rule for solving an equation or a set of equations sometimes runs to many lines, equal to a third or a half of the printed page, in one of these volumes.

The subjects include (besides technical terms, laws of signs, fundamental operations, etc.) linear equations in one, two, or more unknowns, quadratic equations, single and simultaneous, a few equations of higher degrees, indeterminate equations of the first degree, simultaneous equations of the first degree, the solution in integers of the equations $Nx^2 + 1 = y^2$ ("square-nature") and $Nx^2 \pm c = y^2$, general indeterminate equations of the second degree, rational right-angled triangles, rational quadrilaterals, linear functions made squares or cubes, double equations of the first and second degrees, and finally the solution of the equation $axy = bx + cy + d$.

The genius of the race for the theory of numbers brought the Hindus by A.D. 1150 to their supreme achievement, the general solution in integers of the indeterminate equation of the first degree in two unknowns and of the famous (miscalled) "Pellian" equation. The first was solved by the method called the 'pulveriser' ('kuṭṭaka'), and the stages through which the solution passed are represented by Aryabhaṭa I (born A.D. 476), Bhāskara I (522), Brahmagupta (628), Mahāvīra (850), Aryabhaṭa II (950), Śrīpati (1059) and Bhāskara II (1150). The editors give the rules stated by each of these writers. The importance attached by the ancient Hindu mathematicians to the method of the 'pulveriser' is attested by the fact that the whole science of algebra was once named after it ('kuṭṭaka-gaṇita", the science of 'kuṭṭaka'). Still more remarkable is the solution in integers of $Nx^2 + 1 = y^2$ (the 'square-nature'). The account begins with Brahmagupta's Lemmas, rediscovered by Euler in 1764 and by Lagrange in 1768, and finishes with the 'cyclic' method described by Bhāskara II (1150). Fermat, Brouncker, Wallis and Euler could do no more than rediscover what the Hindus had given, and only Lagrange supplied the final proof that the 'cyclic' method will in every case produce the desired result whenever N is a number which is not a square.

The book has evidently involved untold research and labour, and cannot be too strongly commended.

Physics in College and School

(1) Électricité et Magnétisme
Par Prof. Gaston Jochmans et Fernand Descans. Pp. 416. (Bruxelles : A. de Boeck ; Paris : Ch. Béranger. 1937.) 150 francs.

(2) College Physics
By Prof. H. A. Perkins. (Prentice-Hall Physics Series.) Pp. ix + 820 + 1 plate. (New York : Prentice-Hall, Inc. ; London, Glasgow and Bombay : Blackie and Son, Ltd., 1938.) 3.75 dollars ; 15*s.* net.

(3) An Outline of Physics
By Prof. A. E. Caswell. Revised edition. Pp. ix + 590 + 1 plate. (New York : The Macmillan Company, 1938.) 3.95 dollars.

(4) The Elements of Physics
By Prof. Alpheus W. Smith. Fourth edition. Pp. xix + 790 + 7 plates. (New York and London : McGraw-Hill Book Co., Inc., 1938.) 21*s.*

(5) Light
By F. Bray. Second edition. Pp. xii + 369 + 4 plates. (London : Edward Arnold and Co., 1938.) 7*s.* 6*d.*

(6) School Electricity
By W. E. Pearce. Pp. xii + 296. (London : G. Bell and Sons, Ltd., 1938.) 4*s.*

(7) Concise School Physics :
Heat, Light and Sound. By R. G. Shackel. Pp. ix + 177–477. (London, New York and Toronto : Longmans, Green and Co., Ltd., 1938.) 3*s.* 6*d.*

(8) A Complete Revision Physics, Notes and Questions :
Hydrostatics, Heat, Light, Sound, Magnetism and Electricity. By S. R. Humby and F. W. Goddard. Pp. viii + 303. (London, New York and Toronto : Longmans, Green and Co., Ltd., 1938.) 3*s.* 9*d.*

(1) THE first of the books under notice presents a clear and well-arranged exposition of the foundations of the mathematical theory of electricity and magnetism. It covers the usual ground in electrostatics, magnetism and electrodynamics ; and there is an appendix on the equations of Lagrange and Maxwell. Vectors are introduced and used from the beginning. The book is intended for students of electrical engineering at the University of Brussels and, in consequence, more attention than usual is paid to applications of all kinds. The book may be recommended to honours students, who would find the simple and detailed explanations useful.

(2, 3, 4) The next three books in the list are alike in many ways and the title of 'college physics' would apply to them all. They all provide a good conspectus of the subject ; they all assume considerable knowledge on the part of the reader ; and they all give something more than a glimpse of the work which awaits a future specialist. In the United States, science is usually presented to the young in a very liberal manner. In these books, the authors consolidate the ideas which the students should have acquired and they carry the story much further. In every case, the books could be used with advantage by those who are preparing for higher school certificate examinations. A further point of resemblance is that the mathematics connected with the work is kept on an elementary level, though Prof. Alpheus Smith introduces the methods of the calculus in some useful appendixes. Now for the differences :

Prof. Perkins uses the language of mathematics freely, for he believes that most students find a concise symbolic treatment easier to grasp than a verbal one. He strongly emphasizes the quantitative aspects of the subject and rather avoids its applications to everyday life. The latter he leaves to the teacher, while he himself endeavours to make his text so clear that the students may understand the physical principles without further assistance. His book is better suited to the future specialist than to one for whom physics will not be of absorbing interest in after life.

Prof. Caswell goes to the opposite extreme. Taking the view that most of the students who use his book will never take a more advanced course in physics, he includes a great deal of illustrative material, the result being that the space which remains seems scarcely sufficient for the orderly presentation of his subject. For example, within the first thirty pages of his text, he defines conservation of energy, mass, vector quantity, gram-molecular-weight, electrons, protons, atomic number and valency ; which certainly is quick going.

Prof. Smith steers a middle course by keeping the logical development of his subject in the foreground, while providing a wealth of illustrative matter in small type. Thus the continuity of thought is not broken, but the work is lightened for the student and reality is lent to the whole. In this, the fourth edition of Prof. Smith's work, he has introduced a separate chapter on nuclear physics and has added one on astrophysics.

(5) Mr. Bray's book is a straightforward work with certain pleasing features, one being the insertion of many historical notes. In this edition, the chapters on photometry and spectra have been rewritten in accordance with the progress which

has been made during the last decade. The scope of the work may be indicated by saying that it concludes with a selection of questions taken from higher certificate and university entrance scholarship examinations.

(6, 7, 8) The remaining three books are concerned chiefly with work at about the school certificate level. Many teachers will be glad that Mr. Pearce has followed up his "School Physics" with a "School Electricity", for he writes clearly and his book is beautifully produced. The final chapter on modern developments should incline many students to continue their study of physics.

Mr. Shackel's book is the second part of his "Concise School Physics". It is a worthy successor of the first part, "Mechanics", on which an appreciative comment was made in NATURE of September 24, 1938, p. 551.

Finally, Messrs. Humby and Goddard's "A Complete Revision Physics, Notes and Questions" has already proved a useful tool in the hands of teachers during final revision for the school certificate, army entrance and kindred examinations. In the present volume, magnetism and electricity are added to the hydrostatics, heat, light and sound of the former one.

Animal Language

Animal Language
Described by Julian Huxley, recorded by Ludwig Koch and the Parlophone Company. Pp. xi+62+31 plates. (London: *Country Life*, Ltd., 1938.) With 2 Records, 21*s*. net.

ALTHOUGH the noises made by animals are among the most familiar sounds in Nature, they have seldom been the subject of serious biological or psychological study. The present work is an attempt to provide a clearer understanding of the significance of animal sounds than can be obtained by the perusal of an ordinary book. The publishers explain that a 'sound-book' of this type is the natural medium whereby text, picture and gramophone records form a natural unity in which the text comes to real life through the records and vice versa. Individual readers must judge, for themselves, how far this ambition has been fulfilled.

Preliminary inspection suggests that the book is well illustrated. In a sense this is true, but it is disappointing to find that few, if any, of the numerous illustrations are really relevant in the sense that they aid materially in an understanding of the text or in an interpretation of the records. The photographs, nearly forty in number, are no doubt interesting in themselves, but they are seldom attractive; the harsh contrast of tones produces, on some observers at least, a somewhat displeasing impression.

The text of the book is full of interest, for it reveals the paucity as well as the extent of our knowledge. Dr. Huxley covers the whole animal kingdom in his survey and has collected together a wealth of otherwise scattered information. It is sad to find that we must abandon our belief in the soothing influence of the snake charmer's pipe, but it is comforting to think that the ears of the common female frog may lead her with some certainty to the embraces of that male whose individual song is best attuned to her own fancy.

The interpretation of animal sounds is a fascinating but difficult subject, and it is therefore unfortunate that the evidence in support of Dr. Huxley's views is seldom presented in sufficient detail to enable the reader to form an independent judgment. At times, Dr. Huxley expresses his own views with considerable confidence. "What is the point of a rattle-snake's rattling? The answer is really very simple. The snake doesn't want to strike unless it has to. It might very easily get trodden on. . . . The rattle is a warning to the intruder to keep away. . . . In the same sort of way those who instal burglar alarms in their houses put up a notice to that effect outside." This may be so, but whether it is an established truth or simply an *ad hoc* hypothesis we are given no real evidence to decide.

The text of the book is of very considerable length, and one reads on in the hope of reaching eventually a detailed consideration of the gramophone records. Unfortunately, one is doomed to disappointment, although the records themselves present unique material for the study of 'animal language'. The first record is composed of isolated sounds from a variety of mammals; most of them are associated with anger, food or sex. Each section of the record must be played several times in succession before it yields its full flavour; it is, however, well worth while to educate one's ear to the 'gurgling' of a satisfied Arabian camel or to the 'whispering whinny' of an amorous panda. The 'African night' record is definitely exciting, particularly if played out of doors on a dark night.

The book is extremely well produced, and one gets the impression that a closer liaison between the three authors would have avoided some of the limitations to which this review pays, perhaps, too much attention.

Electrode Potentials

The Electrode Potential Behaviour of Corroding Metals in Aqueous Solutions
By O. Gatty and Dr. E. C. R. Spooner. Pp. xi + 504. (Oxford: Clarendon Press; London: Oxford University Press, 1938.) 25*s*. net.

MUCH in electrochemistry is controversial, and fresh outlooks and ideas are exceedingly stimulating. This book is justified by the ingenuity of speculation advanced, quite apart from the very considerable amount of data, largely original, presented upon the electrode potential characteristics of a large number of the more important metals.

The arrangement is certainly unorthodox for a work which may well be considered standard, but the context falls easily into the collection of papers presented, and is quite easy for reference even if it does suffer from the lack of a subject index.

A large introductory paper deals with theory: it is well arranged, comprehensive, often original in outlook, and rich in references. There follows, in a number of papers, a treatment of the specific behaviour of many metals; very clear descriptions of the experimental technique adopted are given, and the analysis and discussion of phenomena presented are critical.

In particular, the paper on iron should receive mention, from the importance of the metal, and from the comparative length of the treatment given. It outlines work published upon behaviour, stresses the importance of the time factor in potential measurement interpretation, and elucidates much concerning the nature of the corrosion of iron, passivity, the effects of solute nature, *p*H, temperature, grinding, oxygen diffusion, etc. It is exceedingly clear upon the mechanism whereby the inhibition of corrosion is effected by chromates.

There are a number of appendixes of some length, forming a not unimportant part of the whole. One treats with very recent work in overvoltage, some of which has not otherwise been published. Another deals with developments in the theory of tarnishing, applications of which to the treatment of silver, copper, and aluminium bronze, have much promise.

This book is of very definite utility to electrochemists and corrosion chemists, and should be of considerable interest to many others. A. J. G.

Fingerprints

Fingerprints:
History, Law and Romance. By George Wilton Wilton. Pp. xix + 317 + 10 plates. (London, Edinburgh and Glasgow: William Hodge and Co., Ltd., 1938.) 12*s*. 6*d*. net.

THE central topic of Mr. Wilton's book on fingerprints is the claim of Henry Faulds (1843–1930) to have been the originator of the use of fingerprints in criminal identification and detection. In 1880 a letter appeared in NATURE, (22, 605; Oct. 28) from Faulds, a medical missionary in Japan, stating that his study of fingerprints, initiated by his observation of impressions on Japanese prehistoric pottery, had led him to the conclusion that bloody impressions on clay, glass, etc., might lead to the scientific identification of criminals. In a later issue of NATURE of the same year (23, 76; Nov. 25), Sir W. J. Herschel wrote to point out that he had used fingerprints in India for more than twenty years.

Mr. Wilton traces the subsequent history of the study of fingerprints in relation to criminal identification and the introduction of the fingerprint system of identification of habitual criminals in English police work. The part played by Sir Francis Galton in the matter is consistently and sometimes violently attacked. While Mr. Wilton's use of the documentary evidence is not unfair, his championship of Faulds leads him to take an unduly harsh view of Galton's undoubted neglect of Faulds's work. On the other hand, there can be no doubt that it was through Galton's work and influence alone that the police authorities adopted the system, which was introduced by Sir E. Henry at Scotland Yard in 1901.

Had Mr. Wilton a closer acquaintance with conditions at the time, he could scarcely have maintained that Faulds's work affected the issue in the slightest. Priority of publication undoubtedly belongs to Faulds; but it was Herschel's practical experience in India that influenced Galton; and it was Galton's work, especially in the classification of fingerprints, and his prestige as a man of science that was responsible for the substitution of the fingerprint for the anthropometric system which had been adopted by the police on the model of the Bertillon system in the latter half of the nineties of the last century.

La fluorescence en biochimie

Par Prof. Ch. Dhéré. (Les problèmes biologiques, 21.) Pp. xii+318+27 plates. (Paris: Les Presses universitaires de France, 1937.) 80 francs.

IN some respects this treatise may be regarded as a counterpart of the same author's contribution to Abderhalden's "Handbuch der biologischen Arbeitsmethoden" reviewed in NATURE in 1935. However, it is by no means a translation, for the arrangement is different, and much of the matter has been brought well up to date; indeed, the author (p. xi) distinguishes between the two works.

The treatment is concise and eminently practical throughout, and anticipates possible experimental difficulties on the part of the inquirer; for example, on p. 233, the author, speaking of hæmatoporphyrine in pyridine, leads the reader from the first impression that there is only one fluorescent band to the discovery that there are really two. Apparatus is described in detail. The main themes of practical interest to the biologist are dealt with in separate chapters, where each receives such comprehensive treatment that few readers will fail to gain either the information or the guidance they need; for example, those on glucides, fats, proteins, alkaloids, chlorophylls, bile pigments, vitamins, microbes, each with its own bibliography; these occupy 250 pages. The present reviewer does not recall the toluene experiments attributed to him (p. 69); his own more recent work, as yet unpublished, makes him critical of any observations on the fluorescence of the sugars, including his own earlier work, unless the material has been rigorously purified; hence the data on pp. 65–68 should be read with discrimination.

The book is not burdened with much theory, but it discusses at some length spectroscopic aspects of the subject. It is furnished with fifty-two figures in the text, and a further fifty-six, mainly spectrograms, in twenty-seven plates. The book as a whole is well produced.

S. JUDD LEWIS.

A Systematic Review of the Genus Phylloscopus (Willow-Warblers or Leaf-Warblers)

By Claud B. Ticehurst. Pp. viii+193+2 plates. (London: British Museum (Natural History), 1938.) 10s.

DR. TICEHURST has for long been recognized as an authority on the willow-warblers, and this critical revision of that group is a model of what such a work should be. He has based it primarily on his own examination of thousands of specimens available in museum collections, and only secondarily on the previous literature. By his determination, there are thirty species in the genus and these comprise, in all, sixty-seven separable forms. They are distributed across Europe and Asia, the largest number of forms being found in the mountain ranges bordering the Tibetan plateau: two are strangely isolated on the islands of Flores and Timor.

Of the three which breed in the British Isles, the ordinary willow-wren and the chiffchaff are scarcely distinguishable by sight under ordinary field conditions, although their songs are strikingly different, and this is indicative of the difficulty of the group as a whole. The complexity is increased by the fact that allied species show parallel variations in corresponding parts of the area which they jointly inhabit; but this is itself one of the points of general biological interest which emerge in the present study.

Most of the forms are migratory, and although information as to winter ranges is in many cases still far from complete, the general trends are becoming clearer. One form which breeds only in north-eastern Siberia winters in Africa, and one with a breeding range extending as far west as northern Norway does not winter nearer there than Siam: these two movements, the greatest exhibited in the group, cross each other at right angles.

The book includes useful sketch maps illustrating distribution and migration; the two coloured plates by Mr. Roland Green show eleven species of which no plate had hitherto been published.

Index Kewensis Plantarum Phanerogamarum

Supplementum 9: Nomina et Synonyma omnium Generum et Specierum ab initio anni 1931 usque ad finem anni 1935 nonnulla etiam antea edita complectens. Ductu et consilio A. W. Hill. Confecerunt Herbarii Horti Regii Botanici Kewensis Curatores. Pp. iii+305. (Oxford: Clarendon Press; London: Oxford University Press, 1938.) 84s. net.

ONLY five years have elapsed since the publication of Supplement 8 to the "Index Kewensis" and in Supplement 9 botanists are presented with a volume considerably larger than any of its immediate predecessors. Since the first appearance of the "Index" in 1893—made possible by the munificence of Charles Darwin—the publication of each Supplement marks a stage in the progress of systematic botany, and provides the only authoritative list of the names of plants recently described, the author and place of publication of each, together with an indication of the geographical distribution. Of the many important works which emanate from Kew none is so indispensable to botanists in general and to systematists in particular.

The present work is essentially what it sets out to be—an index, and its general plan follows that of earlier Supplements. The size of the volume is some indication of the large amount of work which has been accomplished in the systematic study of Phanerogams during the years indicated on the title page. The new genera which have been described are shared among numerous families, but reference may be made to the considerable number of additions to Compositæ, Gramineæ and Orchidaceæ, while students of so-called critical genera such as *Capsella*, *Rubus*, *Hieracium* and *Taraxacum* will find a large number of new specific names for their consideration.

In the preparation of a work of this kind it is unlikely that omissions will not occur, and in the present Supplement a number of entries refer to species which were described before 1931. There can be nothing but praise, however, for those members of the staff at Kew who have undertaken the compilation of the work and for the great care they have bestowed upon its preparation. The volume is sure of a warm welcome from botanists and horticulturists throughout the world.

J. R. M.

The 200-inch Telescope

By Dr. Walter S. Adams,

Director of the Mount Wilson Observatory, Pasadena, California

DURING the past few years, responsibility for the construction of the 200-inch telescope and the solution of its many problems has lain with the members of three committees organized to deal with various aspects of the project. Of these committees, the Observatory Council is the executive body making final decisions upon major questions which are brought to its attention, the Policy Committee considers general matters relating to the function of the telescope and auxiliary instruments and the future operation of the Observatory, and the Construction Committee deals with all technical subjects connected with the design and construction of the telescope. Both the Policy Committee and the Construction Committee report directly to the Observatory Council.

The membership of the Observatory Council, as at present constituted, consists of representatives from the Board of Trustees and staff of the California Institute of Technology and the director of the Mount Wilson Observatory. The members of the other two committees are from the staffs of the two institutions. Dr. Max Mason is chairman of the Policy and the Construction Committees, and since the death of Dr. George E. Hale has also been chairman of the Observatory Council. Dr. John A. Anderson is the executive officer of the Observatory Council with general charge over the optical and instrument shops, and until January 1, 1939, Captain C. S. McDowell was supervising engineer in charge of construction. The advice and assistance of numerous engineers and men of science throughout the United States have been utilized to advantage on many occasions and have been given most generously.

A review of progress on the 200-inch telescope naturally divides itself into three parts: optical figuring of the 200-inch and auxiliary mirrors; design and construction of the mounting and drive; and construction and erection on Palomar Mountain.

Optical Work

The present figure of the 200-inch mirror approximates closely that of a sphere with a radius of curvature of 111 feet. The disk was first shaped on front, back, and edges by grinding with coarse carborundum and the centre was then hollowed out to a depth of about $3\frac{3}{4}$ inches with the aid, first of a 50-inch tool, and then of successively larger tools up to the full size of 200 inches. As the spherical figure was approached, finer grades of carborundum were used so that when optical tests became necessary only a few hours of polishing were needed to give the surface sufficient reflecting power. During the first stages of work upon the disk, the cylindrical holes on the back of the mirror and the large areas between the supporting ribs were filled with plaster of Paris, and after the face and back had been made parallel the 40-inch opening at the centre of the disk was closed with a glass plug weighing about one ton. The plaster of Paris was removed when the surface had reached nearly the required form, and the mirror was placed upon rubber pads which rest on the frame of the support system of multiple counter-weighted levers. The friction of these pads was required to neutralize the strong lateral pull of the grinding and polishing tools making contact over so large a surface, and for this reason the horizontal plates of the supporting system were not engaged. The optical tests, however, were made with the mirror vertical and balanced upon the support system just as it will be when in use on the telescope. Future optical work, including the parabolizing, will be carried on with the mirror resting upon the rubber pads; but these will be removed when the figuring is completed.

From the first the optical tests of the mirror proved to be most satisfactory. No change was seen in the figure when the mirror was tipped repeatedly from a horizontal to a vertical position or when it was rotated. Also no local deformations could be detected at the points of contact of the thirty-six individual lever supports. In fact, the support system was found to be performing quite as well as had been hoped by its designers. The length of the radius of curvature proved to be about two inches less than had originally been planned, but this slight difference, amounting to about one inch in the focal length, is far within the limits allowed for in the design of the telescope, and it is probable that no attempt will be made to reduce the amount through polishing. The surface was found to be reasonably free from zones, but a small amount of astigmatism was present amounting to about 0·1 inch in the optical cut-off at the centre of curvature. This

proved to be due to a slight deformation of the disk caused by the horizontal pads upon which the mirror rests, and is being corrected by a small amount of fine grinding after suitable changes in the supporting pads.

Although the final parabolic curve of the surface of the mirror will be only 0·005 in. deeper than the spherical curve, the area is so great and the process of polishing so slow that it is planned to make most of the change through fine grinding and to leave but the final stages of the figuring to the polishing tool. This procedure has already been found successful in figuring the spherical curve.

Accurate tests of the parabolic figure of the 200-inch mirror will require the use, as an auxiliary plane, of the 120-inch mirror. The completion of this mirror will be one of the next major undertakings in the optical shop. It is at present shaped on front, back, and edges, and the surface has been ground approximately flat. It is planned to figure the three auxiliary hyperbolic mirrors, one for the Cassegrainian and two for the coudé combination, by the method devised by Hindle, without the use of the 200-inch mirror. Four spherical mirrors, each about 40 inches in diameter and with a radius of curvature of 25 feet, are being prepared for this purpose, two being very nearly completed. The mirrors will be used side by side in a clover-leaf pattern and provided with adjustments for bringing their centres of curvature into accurate coincidence.

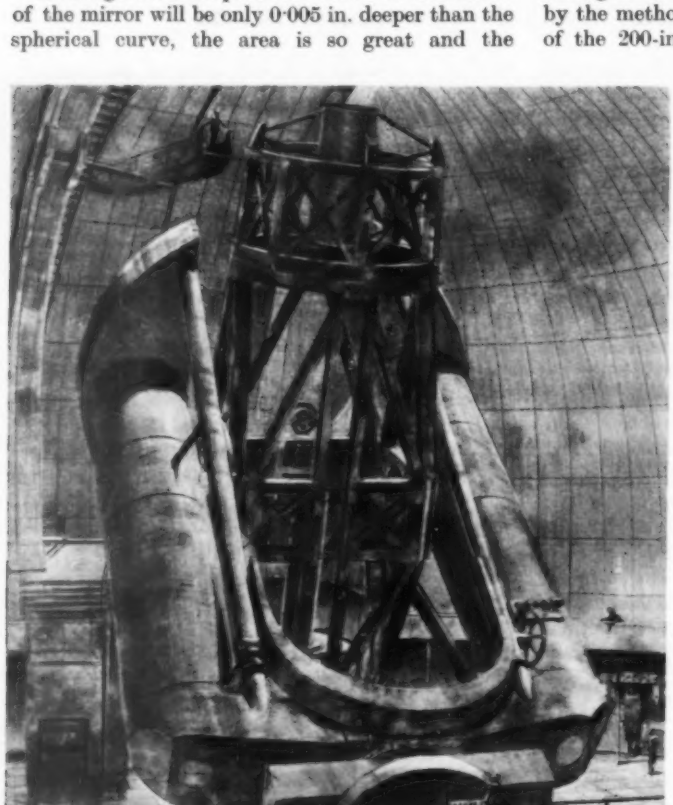


Fig. 1.

DRAWING SHOWING THE SIDE MEMBERS OF THE YOKE WITH THE TELESCOPE 'TUBE' BETWEEN THEM.

A few figures are of interest as indicating the scale of the optical work on the 200-inch mirror. About five tons of glass have been removed in the process of shaping and figuring, and about 20 tons of carborundum have been used for grinding. During the polishing, about 50 pounds of rouge an hour is the average consumption with the full-sized tool, and but a small fraction of this material can be salvaged. As a result rouge has been purchased in quantities hitherto quite unfamiliar to dealers in optical supplies.

MOUNTING AND DRIVE

The major portions of the telescope mounting have been under construction during the past few years at the South Philadelphia plant of the Westinghouse Electric and Manufacturing Company. They were completed and shipped in October and have been transported to Palomar Mountain, where erection has been in progress since November. These parts include the tube, the north and south members of the yoke, the two east and west members, each of which consists of three sections, which, when joined, form a 60-foot tube 10 feet in diameter, the declination bearings and the hemispherical south bearing of the polar axis with its oil pads. Several of the individual pieces weigh between 45 and 55 tons, and the total weight of the completed mounting will approximate

500 tons. The north and south bearings of the telescope are on oil films maintained under high pressure, while the declination bearings are of the ball type. At the present time the south member of the yoke has been placed in position on its bearings and the supports for the oil pads at the north end are installed in readiness to receive the section of the yoke which will form the journal supporting this end of the telescope. This feature of the mounting is a welded structure, shaped like a horseshoe, about 4 feet deep and 46 feet in diameter. It was machined with the tips of the crescent under tension so that it will have an accurate circular form when carrying the weight of the telescope.

The large gear wheels, two for the right ascension drive and one for the declination, are 14 feet 3 inches in diameter, and are being cut and ground in the Pasadena instrument shop, where all the control mechanism is under construction. The driving control of the telescope will be electric with a five per cent range in rate, and the instrument will be provided with computing devices for automatic settings in position.

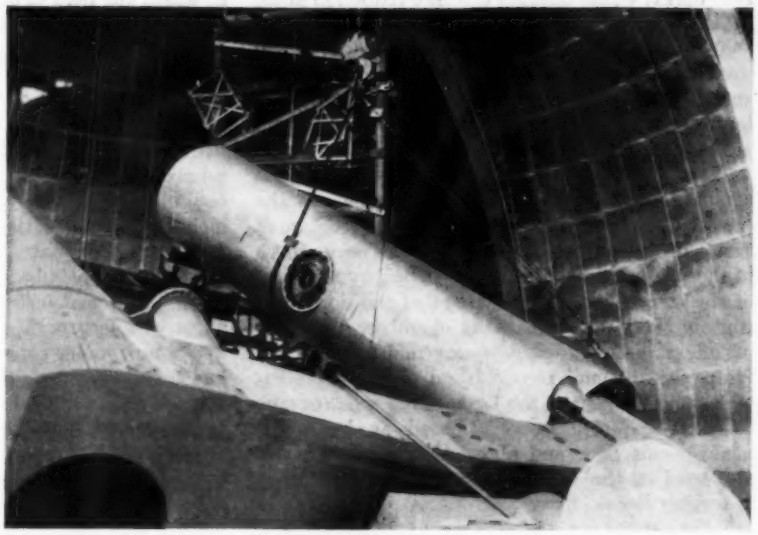


Fig. 3.
ERECTION IN THE DOME ON PALOMAR MOUNTAIN.

CONSTRUCTION AND AUXILIARY INSTRUMENTS ON PALOMAR MOUNTAIN

The dome to house the 200-inch telescope is 137 feet in diameter and has been built and erected. The building is of double construction throughout with an air space between the two walls and heavy insulation on the inner wall. The insulation of the steel dome is by means of aluminium foil set in panels 5 inches thick, which cover the entire interior surface including the 35-foot split shutter. It is expected that the daily temperature range within the dome will not exceed 3 degrees. The outer shell of the dome is of monocoque construction, consisting of three-eighths-inch steel plates welded together and stiffened by an interior framing of girders and arches.

The dome weighs about 1,000 tons and is mounted on thirty-two trucks with spring adjustments and forged steel wheels. The rails are welded to avoid joints and have been ground to a bevel so that the motion of the dome gives very little vibration. The driving mechanism consists of two motors,

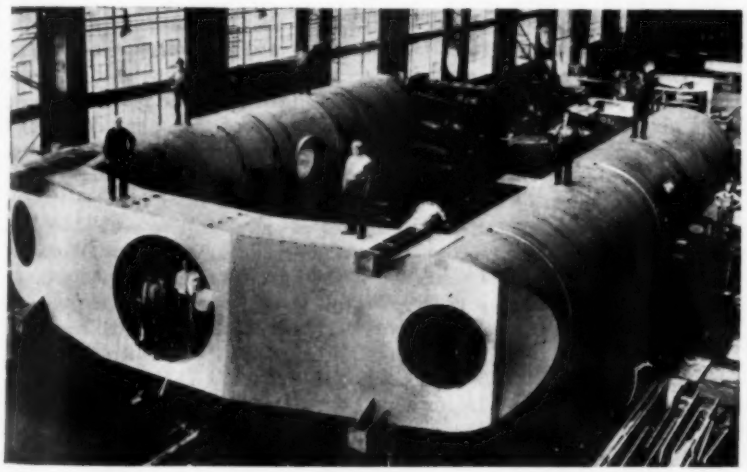


Fig. 2.
SOUTH AND SIDE MEMBERS OF THE YOKE AT THE FACTORY.

180° apart, which operate through reduction gears to turn rubber-faced driving wheels which are held by springs against the vertical flanges of the rotating dome. This design has proved effective, and the friction of the rubber faces provides a brake against rotation of the dome, by high winds.

A travelling crane with a capacity of 60 tons is attached to the main arches of the dome, and the platform for carrying the observer to the small turret in the centre of the tube at the prime focus of the telescope will also be supported by this part of the structure. The basement of the dome will contain the large aluminizing chamber, a number of offices, photographic rooms under controlled temperature, small physical and chemical laboratories and the pier of the large coudé spectrograph room. The electrical control boards are housed on a mezzanine floor, and above this but just below the level of the telescope mounting is the main observing floor.

It is essential in the case of the 200-inch telescope, in which the field of sharp definition at the centre of the photographic plate is limited and the value of observing time is extremely high, that the observational programme be defined as accurately as possible through survey work and identification of objects with instruments having wide angular fields and great light efficiency. Two Schmidt telescopes have been planned for this purpose, one of which, with an effective aperture of 18 inches and a focal ratio of 2·0, has been in operation for about three years. It has been most productive in studies of nebulæ and the discovery of supernovæ. A second instrument of this type, with an effective aperture of 48 inches and of focal ratio 2·5, is now under construction. The 45-foot dome has been erected on Palomar Mountain and the 72-inch pyrex disk for the spherical mirror has been received from the Corning Glass Works. The figuring and support of the 48-inch Schmidt correcting plate, which will not exceed one-half inch in thickness, will present some interesting optical and mechanical problems.

The Cell Theory

Its Past, Present and Future

AMONG the important meetings held by the American Association at Richmond, Virginia, in December, were those dealing with the cell theory—its development, its present status, and its future possibilities. These meetings were in the nature of a symposium and combined the best thought of the three sections of the Association, on history, botany, and zoology, which collaborated in the programme.

Seven outstanding papers by eminent scholars were presented in two sessions, morning and afternoon of December 27. Those taking part were: Prof. L. L. Woodruff of Yale University; Prof. J. S. Karling of Columbia University; Prof. E. G. Conklin of Princeton University; Prof. G. A. Baitsell of Yale University; Prof. Paul Weiss of the University of Chicago; Prof. Franz Schrader of Columbia University; and Prof. C. E. McClung of the University of Pennsylvania. The discussion and attendance throughout were exceptionally good, more than a hundred and fifty being present at the afternoon meeting.

The morning session, which was devoted to historical aspects, brought some surprising results, especially as bearing upon the two men, Schleiden and Schwann, who up to the present day have generally been given most credit with respect to the origin of the cell theory, which they were supposed to have enunciated a century ago [see also NATURE of February 18, p. 293].

There was apparent agreement in the scholarly papers presented by Profs. Karling and Conklin that the cell theory was projected some time prior to the appearance of the works of Schleiden and Schwann, that these two men added nothing either in content or in clarity with respect to the theory as such, and that they in fact lent support to a general view of cell formation which was completely erroneous.

Prof. Woodruff dealt with the preceding period and with the influence of the microscope. One hundred and seventy years before 1838, Robert Hooke had described little boxes or cells seen under the microscope, and from his day onward other significant observations on cells had been recorded by such men as Malpighi, Grew, Wolff, and Lamarck. With the beginning of the nineteenth century, the cell theory came into sharper focus and received fairly clear and explicit delineation at the hands of Mirbel (1802–1809), Dutrochet (1824), Turpin (1826), Meyen (1828–1838), Brown (1831), Demortier (1832), Purkinje (1835), Mohl (1835–1838), and Valentin (1838).

All these significant contributions preceded the works of Schleiden and Schwann. Why then, it was asked, have the two men been called the

founders of the cell theory? Why the amazing situation "that we still continue to call it after them"? It would seem, as suggested by Profs. Karling and Conklin, that bluff and brag on Schleiden's part entered very largely into the picture. He underestimated, ignored, or ridiculed really important contributions of predecessors and contemporaries, and thus gained a wholly unwarranted recognition; and Schwann borrowed from Schleiden's arrogant claims as to plant cells and applied the same views to animal cells. Prof. Conklin concluded his most interesting paper by suggesting that "it would be more accurate as well as more becoming to strike out of our literature these personal possession tags attached to important discoveries, such as . . . the cell theory of Schleiden and Schwann!"

The afternoon session of the symposium, devoted to the present and the future of the cell theory, developed what appeared like a cleavage in points of view between those who see the problem primarily in terms of physical forces (of surface tensions, physical pressures, and electrical attractions and repulsions), and those who hold that living matter exhibits certain characteristics (such as variability, selective direction, and unfoldment in a temporal sequence) which sharply differentiate the organic from the inorganic.

It was generally agreed that the organization of the cell is exceedingly complex and that there is still much to be learned about it. Yet, on one hand it was maintained by Prof. Baitsell that the difference between the organic and the inorganic is "not one of *kind* but merely of *degree of complexity*. . . . Since the same materials are used in both domains, they must conform to the same elemental patterns." Recent advances in cellular knowledge are due primarily to the work of physicists and chemists. Prof. Schrader, who was concerned chiefly with the present status of mitosis, asked for renewed consideration of a 'dynamic' hypothesis. He suggested, however, that such a hypothesis meets with many difficulties which recent findings have by no means removed, and that it is a foregone conclusion that the final explanation will not be as simple as had once been thought.

On the other hand, it was pointed out by Profs. Weiss and McClung that, although "the cells derived from an egg have definite, innate capacities of their own . . . the fact that the individual cell can differentiate in a variety of directions but actually differentiates only in one, calls for factors which direct each cell selectively into its proper course. These factors, by their very nature, are super-cellular." They apparently derive from the organism as a whole and suggest the presence of "racial material in a linear order within the chromosomes. . . . Since living systems have unique phenomena of a higher order (than the non-living), like reproduction, metabolism, and consciousness, it is only logical to conclude that there must be units of a new order to explain them."

The participants in the afternoon meeting were in if necessary agreement that there is no sharp break between the living and the non-living. The progressive series of integrations does not stop at the molecular but continues to higher orders. Furthermore, the chemical elements found in the living orders, and their physical and chemical properties and interactions, are, it would seem, precisely the same as those found in the non-living orders. If there was difference of opinion, it appeared to be as to whether the integrations of a higher order (such as the cellular) could be completely explained in terms of principles derived from a lower order (such as the molecular), or whether, since the living orders have properties not found in the non-living, they must have their own peculiar units and be explained primarily in terms of those units. The future, it was held, should soon bring us closer to a resolution of such disputed questions. JOSEPH MAYER.

Obituary Notices

Prof. A. Smithells, C.M.G., F.R.S.

THE death of Prof. Arthur Smithells, on February 8 at the age of seventy-eight years, has removed from the world of science one of the most distinguished participants in the successful effort that has been made in the last half century to break down the barriers between a science too isolated and self-satisfied and a community too indifferent and unconscious of its own needs. No man could be more permeated than he was with a real reverence and enthusiasm for scientific work and achievement. His more intimate personal friendships were almost entirely with men of science, and his own work on the structure of flame was marked by keen insight and exceptional experimental ingenuity and skill.

Smithells was trained at Owens College, Manchester, and went on to enjoy the pleasant life and invigorating mental atmosphere which Munich and Heidelberg offered to students in those days, returning to an assistant lectureship at Owens. But, at the early age of twenty-five years, he was called to the chair of chemistry at the Yorkshire College in Leeds, and there was faced with the responsibilities and opportunities of a provincial college which was aspiring to be a university, and of a school of chemistry in a great industrial centre. Then came a

division of his activities and a multiplication of interests. His distinguished presence and faculty for the vivid presentment of ideas in speech or writing, and his capacity for the formation of wise and tolerant judgments, won for him quickly the confidence of both academic and lay elements inside and outside the Yorkshire College, and his work in aiding its development into the University of Leeds, by way of the federal Victoria University, was of inestimable value. As a trusted member of Senate and Council, as pro-vice-chancellor and as chairman of the Board of Science and Technology, he placed himself unsparingly at the service of the University in a successful endeavour to collaborate in securing for it the best of university traditions, while maintaining and developing its special character as a school of applied science of international reputation.

In 'pure' chemistry, Smithells obtained the co-operation of his life-long friend, Julius Cohen, and that of his pupil, Dawson, for organic and physical chemistry respectively, and was largely responsible for the appearance of such names as Procter, Green and A. G. Perkin on the list of teachers and research workers in special departments of applied chemistry. His own lecture courses were admirably planned and delivered. Although of necessity so much diverted by claims of university statesmanship and administration, he worked for many years on the subject of flame structure. He became a fellow of the Royal Society in 1901 and president of Section B (Chemistry) of the British Association in 1907. His instinct urged the application of this branch of science to practice and led him to make contacts with the gas industry by a series of striking lectures and by productive conversations. One outcome was the foundation by the gas industry in 1910 of the Livesey professorship of coal gas and fuel industries in the University of Leeds as a memorial to Sir George Livesey, W. A. Bone becoming the first occupant of the chair. Another result was the formation of the Joint Research Committee of the University and the Institution of Gas Engineers, with Smithells as its first chairman. This Committee, unique at the time of its formation, has gradually increased the scope of its work, and Smithells was made its first honorary member a few weeks before his death. The Society of British Gas Industries too honoured him by election to its presidency in 1911.

Another way in which Smithells was anxious to see scientific training and method take its proper place in the arts of life was indicated by those activities which led to his appointment as honorary educational adviser on home science and household economics in King's College, London, where such ideas received more toleration than elsewhere and have since come into a well-deserved prominence.

In 1913 came a break in Smithells' activities at Leeds, arising out of the interest he had displayed in the training of Indian students. He was invited to go as special lecturer to the Punjab University, and accepted willingly since he was anxious to illustrate how, in his opinion, the subject of chemistry might be made to appeal to the mentality of the Indian student and carry him from theory to practice.

His generous and peaceful soul, with its memories of student days in Germany, was greatly shocked by the outbreak of war in 1914; but, like many others, he felt impelled to help and, first as special lecturer in the Northern Command and later as chief chemical adviser on anti-gas training to the Home Forces, with an office at the Horse Guards and the rank of lieutenant-colonel, he rendered services which were recognized by the distinction of C.M.G.

In 1923, after a few more years at Leeds in the busy post-War period, Smithells resigned the professorship he had held so long in order to take up the congenial duties of the director of the Salters' Institute in London. There he was occupied in the selection of promising young graduates in chemistry who might receive the endowment of the Institute in a further carefully planned training which should fit them for responsible work in industry. His personal knowledge of, and friendship with, so many who counted in the universities and in the various chemical industries, and his powers of judging and advising young men were here invaluable, and he was actively occupied with the duties of this post until failing health dictated his retirement in 1937. It was during this period that he interested himself specially in the Institute of Chemistry and was president for the term 1927–30. He was Harrison lecturer in 1935. Manchester, the university of his studentship, and Leeds, that of his professorship, both conferred upon him the honorary doctorate of science.

In writing, as in speech, Smithells was both lucid and convincing. This was apparent in the accounts of his scientific work submitted to the learned societies and in his lectures. His letters were greatly valued by those privileged to receive them for the same qualities, with more intimate, human and humorous touches and occasional accompanying sketches of persons—often children, in whom he delighted. He could never settle down to the writing of a treatise or text-book, but the Oxford University Press published a collection of his addresses, under the title "From a Modern University", dealing with such subjects as "The Relation of Universities to Technical and Professional Education", "The University and Women's Work", "Professors and Practical Men" and "The Modern University Movement".

Arthur Smithells was the third son of James Smithells and Martha, the daughter of James Livesey. He was twice married—in 1886 to Constance Marie (daughter of F. Mawe) and in 1908 to Katharine (daughter of Arthur Booth), who survives him. He had two sons and one daughter by his first, and one son by his second marriage. JOHN W. COBB.

Prof. Robert Wallace

PROF. ROBERT WALLACE, professor of agriculture in the University of Edinburgh from 1885 until 1922, died at Kincardine-on-Forth on January 16 at the age of eighty-five years. The chair of agriculture, the oldest in the country, goes back to 1790, and Wallace

and his three predecessors in office, all men of mark, between them filled it for 132 years, a rather remarkable record.

The second son of Mr. Samuel Wallace, who farmed in a large way in Dumfriesshire, Robert Wallace studied agriculture at the University of Edinburgh under Prof. John Wilson, a notable teacher, whose "Farm Crops" was long a standard work. From the University he returned to his native county to engage in the practice of farming, whence in 1882, at the age of twenty-nine years, he was called to be professor of agriculture at the Royal Agricultural College, Cirencester. Three years later he was chosen to succeed Wilson in the Edinburgh chair.

While under such notable teachers as Coventry, Low and Wilson, the agricultural classes at Edinburgh had attracted students from a wide field, there had been up to this time no development of a co-ordinated course in agricultural science. Agricultural students could, and frequently did, take the ordinary classes in chemistry, natural philosophy, botany, natural history and economics; but there were no courses relating these subjects to the practice of agriculture. Wallace, with characteristic energy, set himself to remedy this defect, and the immediate result was the establishment by the University of the B.Sc. degree in agriculture, the first to take the degree being the late Sir William Somerville, afterwards Sibthorpian professor of rural economy in the University of Oxford. At a later stage he was instrumental in obtaining endowments for the establishment of the Steven lectureship in agricultural entomology and of the Garton lectureship in Indian and Colonial agriculture.

The earlier years of the present century were a period of great development in agricultural organization and in agricultural education and research, both in Great Britain and in the Colonies, and the Edinburgh School of Agriculture, first in the field with a comprehensive course in agricultural science of degree standard, was called upon in an extraordinary number of cases to provide men to fill key positions in agricultural departments and in agricultural colleges. One has only to recall such names as Somerville, Middleton, Campbell, Greig, Gordon, Gilchrist, Seton, Milligan and Clouston—to mention a few—to indicate the extent to which the Edinburgh School has influenced agricultural development in the last forty years; and just as no trouble was too great for Wallace to get his former students placed, so nothing gave him more pride and satisfaction than the successes later achieved by them.

Throughout the greater part of the tenure of his chair, Wallace lived under the happy dispensation of the two-term (winter session) academic year, and for many summers he travelled widely to study agriculture under varying climatic conditions. India, Australia, South Africa, Rhodesia, the United States, Canada, Mexico, Egypt, Greece and Italy all came under investigation, and the fruits of his studies gave a refreshing quality to opening lectures and were embodied in many books—for he was an indefatigable and voluminous writer. His best known book is "Farm Live-Stock of Great Britain", which, first published in 1885, has gone through many editions, and is still a standard work.

A perfervid champion of a wide range of causes, Wallace could scarcely avoid achieving a state of variance with quite a number of people, but none who really knew him could fail to appreciate the essential kindliness, the rare generosity of the man.

E. SHEARER.

Mr. J. O. Borley, O.B.E.

MR. J. O. BORLEY, who died at Bexley, Kent, on December 30, at the age of sixty-six years, had retired only a year or so before from the post of fisheries adviser to the Discovery Committee (Colonial Office), and was still an active member of that Committee. His interest in whaling and antarctic research dated from his membership of the original Falkland Islands Committee, the recommendations of which led to the splendid investigations carried out under the auspices of the Discovery Committee. Borley took a great part in the planning of these investigations and in their administration. His thorough grasp of practical problems and the soundness and sobriety of his judgment were of the greatest assistance in the negotiations which led up to the international regulation of whaling.

The success of his work on the whaling problem was, I think, largely due to his long and intimate experience of fishery research, for up to 1928, when he joined the Colonial Office, Borley's life-work was the investigation of fishery problems. He started his fishery career at Lowestoft in 1903 under the Marine Biological Association, which, at that time, was responsible for the English share of the international fishery investigations. In 1910, when this work was transferred to the Board (later Ministry) of Agriculture and Fisheries, Borley moved to London with his staff, and was associated with Dr. A. T. Masterman in the general direction of the investigations. During the Great War, he rendered valuable services to the Ministry and to the Restriction of Enemy Supplies Department in an administrative capacity, which earned him an O.B.E. in 1918. In 1921, after the reorganization of the scientific staff, Borley returned to Lowestoft to take charge of the new Fisheries Laboratory which had been set up there through the energy of Prof. J. Stanley Gardiner.

Borley's own scientific work was concerned mainly with the plaice and the plaice fisheries, on which he became an acknowledged authority of international repute, publishing many papers of great value on this subject. He was an extremely painstaking and thorough worker, and was never content until he could wring out the last drop of information from the elaborate biological and statistical data at his disposal. He took a very keen personal interest in the difficult question of the protection of the plaice fisheries, and worked amazingly hard on the Plaice Committee of the International Council to bring about some effective measure of international control.

It was, I think, a keen disappointment to him that the recommendations of the Plaice Committee of 1921 and of the Plaice Conference at Amsterdam in 1925 could not be put into operation. But he did not lose heart; he supported his staff in working out alternative methods of coping with the overfishing problem, which bore their first fruit in the Sea Fishing Industry Act of 1933.

In addition to his papers on the plaice, Borley published in 1923 an admirable study of the bottom-deposits in the North Sea, and was largely responsible for a special investigation of herring-trawling carried out just before the Great War, on which we reported jointly in 1922.

Borley was a colleague of mine for many years, and no man could wish for a better. He was always helpful, always put the work first and himself second. His great knowledge and experience was always freely at the service of his colleagues. He was a lovable personality, and inspired both affection and respect in all those associated with him in the work of the Fisheries Department, of the International Council for the Exploration of the Sea, and of the Discovery Committee. E. S. RUSSELL.

WE regret to announce the following deaths:

Prof. V. A. Karavajev of Kiev, an authority on the taxonomy and bionomics of ants, on January 7, aged seventy-five years.

Prof. J. P. McMurrich, emeritus professor of anatomy in the University of Toronto, on February 9, aged seventy-nine years.

Prof. N. V. Nassonov, formerly director of the Zoological Museum of the U.S.S.R. Academy of Sciences, on February 10, aged eighty-five years.

News and Views

The Linnean Society and National Parks

As a result of the discussion on the objects of national parks held by the Linnean Society of London on December 8 (NATURE, **142**, 1087; 1938) and subsequent debates, the Society has adopted the following resolution: "The Linnean Society of London accepts the definition employed in the African Fauna Convention as an ideal for the preservation of Nature; but it knows that the term 'National Park' has been given to areas which for various reasons are unsuitable for inclusion within the definition,—e.g. too limited or situated too near populated areas. For such it recommends the setting apart within each Park of special nature reserves under proper control; and it would like all authorities with power over Parks to seek advice from such bodies of naturalists as are competent to give it." The definition given by the African Fauna Convention (H.M. Stationery Office. Treaty Series, No. 27. London, 1933) is as follows: "The expression 'national park' shall denote an area (*a*) placed under public control, the boundaries of which shall not be altered or any portion be capable of alienation except by the competent legislative authority, (*b*) set aside for the propagation, protection and preservation of wild animal life and wild vegetation, and for the preservation of objects of æsthetic, geological, prehistoric, historical, archæological, or other scientific interest for the benefit, advantage, and enjoyment of the general public, (*c*) in which the hunting, killing or capturing of fauna and the destruction or collection of flora is prohibited except by or under the direction or control of the park authorities. In accordance with the above provisions facilities shall, so far as possible, be given to the general public for observing the fauna and flora in national parks."

British Dyestuffs: Award of the Perkin Medal

THE Perkin Medal of the Society of Dyers and Colourists has been awarded to Mr. James Baddiley, of Imperial Chemical Industries Ltd., "in recognition of his national services for the renaissance of the British dyestuffs industry through many important investigations in the field of colour chemistry conducted or directed by him". In the thirty years since its inauguration, the Medal has only been awarded eleven times—four times to Englishmen, three times to Germans, three times to Frenchmen and once to an Alsatian. In an address delivered after the presentation, Mr. Baddiley said that great progress has been made in dyestuffs laboratory technique, such as the use of X-ray diffraction methods for determining molecular structure, optical diffraction in the visible and ultra-violet bands, and cathode-ray refraction. In the dyeing of cotton, substantial advances have been made, particularly with regard to light fastness. In the direct cotton colour field constant research had been given to straight-chain poly-azo dyes with 2-5-7 amino-naphthol-sulphonic acid and its derivatives as end-component, and this line of research had led to the production of the Durazols, which are representative of direct cotton colours of high fastness to light.

THE dyestuffs chemist, affirmed Mr. Baddiley, has shown his ability to meet the problems presented by new artificial fibres very promptly, by producing the Solacets, a series of truly water-soluble dyes, possessing high affinity and building-up properties and capable of being applied as though they were direct cotton dyes. In regard to pigments, Mr. Baddiley mentioned the invention of the phthalocyanines in I.C.I. laboratories; these, he said,

represent the last word in all-round fastness and in tinctorial properties. Turning to textile auxiliaries, he outlined the fundamental principles involved in the modern 'soapless' detergents, the success of which led to intensive research in long-chain chemistry and the production of many new interesting products of which the best known is Velan PF for producing water-repellent finishes resistant to laundering and dry cleaning. Among other advances associated with the dyestuffs industry, Mr. Baddiley referred to the colour film, the discovery of sulphanilamide, and the synthetic polymers.

Commerce and the Universities

THE question of the suitability of existing arrangements in universities for the training of undergraduates for commercial careers was recently investigated by a sub-committee of the Association of British Chambers of Commerce. This body, having examined the subject in the light of information collected from university appointments bureaux, professional bodies, individual firms and various chambers of commerce, drew up a short "Report on the Commercial Employment of Students with Degrees in Commerce". The report estimates at less than a hundred the deliberate annual recruitment of young graduates into commerce for the purpose of ultimately using them for the higher executive posts. These recruits are taken mainly by large concerns engaged in either manufacturing or retailing: no evidence was forthcoming of any appreciable recruitment to wholesale houses or shipping concerns. It appears that the recruitment of graduates on the business side is sporadic and exceptional and the firms which employ them make no special arrangements, such as are common on the industrial side, for their special training in business methods. The sub-committee considers that it would be advantageous to British commerce if a larger proportion of graduates were recruited, but that this will not be possible unless steps are taken to incorporate practical office and commercial experience in the university courses.

THE Association's Executive Council adopted the report and decided to circulate it with a view to a conference with representatives of the universities for discussion of the subject and for the devising, if possible, of a scheme of training in the operation of which the chambers of commerce would collaborate. The kind of collaboration envisaged is indicated by mention in the report of a sandwich system of six months in business alternating with six months of full-time university work, or a preliminary spell of work in business before entering a university, in which studies would be organized in two parts separated by another spell of business employment. The report has been coupled, not, perhaps, very appropriately, with the Spens Report on Secondary Education in a motion agreed to in the House of Commons on February 15 in favour of the Board of Education consulting local education authorities and others as to how far the recommendations in the reports should be carried into effect. Presumably the recommendation of the Chambers of Commerce will be taken up by the Universities Committee of Vice-Chancellors and Principals. In the discussion in Parliament, the Board's attitude towards commercial training in secondary schools was summed up. From eleven to sixteen years of age, geography and mathematics may well be taught so as to arouse an interest in the world of commerce, and there is a real place for commercial training on broad lines after the School Certificate; the prejudice against commerce as unworthy to rank with more academic careers should be eradicated.

An Anatomist Analyses

THE editor of the *Lancet* has begun the interesting experiment of throwing open his journal to selected medical men in various occupations, so that they may express unfettered thoughts upon any subject they choose, under the title "Grains and Scruples". The first series of contributions, five in number, appeared in the numbers of December 1938 "from an Anatomist". They discourse on the alleged gradual but definite degeneration of the medical student, who in former days is said to have been far older, more mature, and more responsible than his successor; upon the disappearance of the old-fashioned schoolboy bug-hunter, and other topics familiar to the teacher of long standing. But years have coloured the outlook, for there are still keen schoolboy naturalists, and while maturity and responsibility are difficult qualities to assess, the records show that the age of entry has been rising instead of falling. In the old days, students entered the universities at years of indiscretion undreamed of now, and the writer knew a surgeon-admiral who as a student, having passed all his medical examinations, put in a year on a whaler, until he should attain the legal age of qualification. That cannot happen often in these days.

BUT more profound puzzles confront the "Anatomist", and he poses the recurrent problem of the persistence in many groups of animals of primitive, generalized types. If changing environments demand the evolution of more complex animals to meet the new needs, how is it that there have survived through aeons of time, apparently completely meeting the requirements without significant structural change, basic forms upon which the higher developments of the group are founded? As examples of these 'immature' forms which have not developed their potentialities, he gives the shark, the giant salamander, the tuatara lizard, the ostrich, and following Bolk's thesis of infantilization he would regard man as the permanent baby amongst mammals, emphasizing that lack of structural specialization which is man's saving grace. Finally he makes a reasoned plea for linking man ancestrally with the pig. But here he controverts his own premises, for while rightly stressing the need for depending upon characters not liable to environmental adaptation, he selects as major resemblances, dentition and hair-covering, length of tail and colour, than which no mammalian characters are more liable to adaptive variation. He does not suggest

how the extremities of man are to be derived from those of the pig, but perhaps he would include the Devil amongst men.

Sir C. V. Raman, F.R.S.

IN 1928, Sir Venkata Raman published an account of the new radiation effect now generally known as the Raman effect, and the Indian Academy of Sciences, of which he is president, has had the happy idea of celebrating this and Sir Venkata's fiftieth birthday by the issue of a special commemorative volume. This volume, which contains thirty-eight papers, submitted from various parts of the world, opens with a brief biography of Sir C. V. Raman. The writer of this, whilst referring to the fact that Sir Venkata received his early training in physics at the Presidency College, Madras, unfortunately omits to mention how much the future Nobel prizewinner owed to the then head of the department of physics, the late Prof. R. Ll. Jones, who carried to India the traditions of the Cavendish Laboratory.

THE contributions to the commemorative volume deal with the many aspects of physics with which Raman has been associated. Only two papers have been submitted by workers in Great Britain : Sutherland contributes a theoretical paper establishing the connexion between the force constant, the internuclear distance, and the heat of dissociation of a diatomic linkage, whilst Angus gives a valuable critical survey of the Raman spectra of terpenes. From Prof. K. W. F. Kohlrausch's laboratory at Graz, which has played so prominent a part in the application of the Raman effect to chemical problems, there are ten papers dealing *inter alia* with asymmetrical phthalyl chloride, dimeric keten, *cyclo*butane-1 : 2-dicarboxylic acid and its derivatives, tetrolic acid and the nitro-group. Papers on analogous subjects have been sent by Bonino and Manzoni-Ansidei, Murti and Seshadri, Mizushima and Moreno. Hibben provides a striking statistical analysis of the trend of Raman effect research during the ten years since its discovery ; he shows how the fuller theoretical understanding of the effect (1932–34) gave an impetus to experimental investigation and discusses the types of organic and inorganic substances which have received attention. The remaining papers are concerned chiefly with the other aspects of optics to which Raman and his students have devoted attention. The volume forms a noteworthy tribute to one who has done so much to further original research in India.

A New "Nomenclator Zoologicus"

THE preparation of a new "Nomenclator Zoologicus", announced in 1935, is now approaching completion. It constitutes an attempt to bring together the names of all the genera and subgenera in zoology that have been described from the tenth edition of Linnaeus, 1758, up to the end of the year 1935, with a bibliographical reference to the original description of each. It will also include the great majority of alternative spellings that have appeared during that period. Another feature that will, it is thought, be found valuable for systematists relates to cases where a new name has been proposed for a homonym. In these instances a cross-reference is given under the homonym to the new name. It is estimated that the work will comprise some 225,000 entries, of which about 5,000 appear to have been omitted from all previous publications of this character. It is proposed to publish the work in four volumes of nearly 1,000 pages each, which it is hoped it will be possible to issue at intervals of about six months. The Zoological Society of London has already borne the whole cost of preparation (approximately £1,800), but the Council of the Society does not feel justified in incurring further expenditure in respect of this enterprise, which would involve an additional £3,600. However, with the aid of various grants from outside sources, the editor, Dr. S. A. Neave, has now been able to arrange for the printing and publication of the work. It is proposed to publish it at the low advance subscription rate of six guineas, postage included, for the four volumes, provided that a sufficient number of undertakings to subscribe can be obtained. If these are adequate, it is hoped to issue the first volume during the coming summer. Subscriptions should be sent to Dr. S. A. Neave, Imperial Institute of Entomology, 41 Queen's Gate, London, S.W.7.

'Modern Man' from Choukoutien, China

SKELETAL remains of 'modern man' of Upper Palæolithic age have at last been found in material from the Choukoutien caves, near Peking, the now world-famous site of discovery of Peking man. This latest find is no more than was to be anticipated from the discovery here some few years ago of relics of palæolithic man ; and indeed it is overdue. The new material, it is stated in a dispatch from the Peking correspondent of *The Times* in the issue of February 21, is from the Upper Cave, and consists of the remains of seven individuals, who, it would appear, had belonged to one family—an old man, estimated to be more than sixty years of age, a younger man, two relatively young women, an adolescent, a child of five, and a new-born baby. Such a varied assemblage should in the ordinary course provide adequate material for arriving at a fairly close approximation to the racial character of the group ; but it would appear that these skeletal remains are remarkably, and indeed unusually, diverse in character for so closely associated a group.

THE brain case of the old man points to a very primitive type, not far removed from Neanderthal man, although in other attributes he approaches European man of the Upper Palæolithic period, while the facial characters suggest recent Mongolian types, without, however, being identical with them. Of the two women's skulls, one presents resemblances to the Melanesian type of New Guinea, while the other is similar to that of the modern Eskimo woman. No features, however, occur among the modern population of North China which would justify attribution of an ancestry leading back to this population of the Upper Cave. Prof. F. Weidenreich is

quoted as suggesting that the Upper Cave people may represent the ancestors of the Amerindian population in process of migration to the crossing from Asia to America. Among the numerous artefacts which have been found in association with the remains—stone and bone implements, perforated teeth, shells, and stones used for ornament—several can be traced to an origin varying from 100 to 200 miles away. This lends support to the view that these were a far-travelled people in a stage of further migration. Injuries shown by the skulls indicate that all the members of the group met with a violent end.

British Optical Instrument Display at World's Fair

THE British optical instrument industry, through the Scientific Instrument Manufacturers' Association, is exhibiting a cross-section of the products of the industry at the World's Fair, New York. Eighteen firms are participating, and the exhibit is arranged in four showcases each 8 ft. by 3 ft. 6 in. by 3 ft., also a series of showcases mounted in two panels 24 ft. by 3 ft. stretching from a centre piece formed of a large mass of optical glass, and two photo murals 16 ft. by 12 ft. with showcards let in. The exhibitor firms have regarded the exhibit from a 'prestige' aspect, and by mutual arrangement each firm has endeavoured to send a limited exhibit of its specialities selected so that there may be no overlapping. In other words, makers of theodolites, levels and microscopes are showing a complete range of products, but built up of several makes rather than various models by each maker for the same purpose. The display is very comprehensive. Both in appearance, finish and presentation it should at least equal anything that has hitherto been devised. It is impossible to refer in the course of a brief note to all the different exhibits. These comprise among the more standard types a course-setting bomb sight, aeroplane sextant, echo depth-sounder, Robbin Hill camera, survey lens for aerial camera, spectrograph, spectrometers, apparatus for measuring pressure in mines and dust counters, measuring microscopes, microtomes, prism binoculars, telescopes, photographic lenses and cameras.

Soil Erosion in Jamaica

SOIL erosion in Jamaica forms the subject of a bulletin (No. 17) issued by its Department of Science and Agriculture. The greater part of the cultivated land is situated on steep hillsides, gradients of one in one being frequent, so that sheet erosion is the major problem. These slopes were originally covered by dense forest and undergrowth, the clearing of which has resulted in rapid loss of surface soil. The rate of loss depends largely on the crop grown. Bananas and coffee, for example, are comparatively widely spaced and are maintained under clean cultivation so that soil exposure is very serious, though the necessity for drains in the case of bananas somewhat alleviates the situation. Sugar-cane, on the other hand, is an excellent soil conserver as it has an elaborate root system and the trash deposited after reaping forms a protective cover. Of the less important crops the cultivation of yams, sweet potatoes, corn or ginger encourages erosion, but citrus causes little loss as the trees are usually left in the grass cover. Erosion is also promoted by the otherwise valuable system of forking the soil at the end of the dry season to facilitate the penetration of the first rains, and by the improper placing of drains. Other factors which contribute to the problem are the practice of short-period tenancy, which gives the proprietor little interest in conserving the fertility of his land, and the system of renting land for the production of one type of crop only. Some fundamental changes in the current agricultural practices will be needed if further loss of valuable soil is to be prevented.

Earthquakes Recorded in India, January–March, 1938

SEISMOLOGICAL information obtained in India is henceforth to be published quarterly as a separate bulletin. The first of these bulletins (*Seis. Bull.*, Jan.–March 1938, Government of India Meteorological Department, Delhi) has been received. It consists of reports from seven instrumental stations, and non-instrumental reports received at Poona. First is given a list of stations with their latitude and longitude to the nearest minute of arc together with other necessary information, and also a list of the instruments and their constants with which each is equipped. For the quarter, Agra records 56 shocks, Bombay 77, Calcutta 89, Colombo 47, Dehra Dun 13, Hyderabad 41, and Kodaikanal 61. The small number recorded at Dehra Dun may be due to poor instrumental equipment. Records for the observatories are separate, giving in each case date, component, phase, time received, period, amplitude, epicentral distance if determined, and remarks concerning the shock or the reception. The macroseismic evidence collected at Poona is valuable, personal observations numbering 62, 12 being from Drosh. The shock with most macroseismic effect was on March 14. It cracked property at East Khandesh, damaged property at Maheswar (Indore) and damaged property, injuring two children, at East Khandesh. Seismologists will be grateful to those concerned with the report for putting the data obtained in a manner convenient for reference, and for taking the important step of having it published at more frequent intervals.

An Electron Diffraction Camera

MESSRS. W. EDWARDS AND CO., Allendale Works, Vaughan Road, London, S.E.5, have recently published details of their Finch electron diffraction camera intended for industrial research. This camera is of the type developed by Prof. G. Ingle Finch, who has done so much to improve the technique of electron diffraction. The camera uses a cold cathode discharge tube as a source of electrons. The fine beam, which is necessary for a sharp diffraction pattern, is obtained by using a series of diaphragms and by focusing the beam upon the screen with a magnetic coil. A useful feature is that both the diaphragm and specimen holders are standardized so that they will fit any of the six ports in the instru-

ment. Moreover, all the necessary adjustments of the diaphragm and specimen can be made *in vacuo* from the outside. The joints are ground and polished flats held in contact by the atmospheric pressure, a point of importance in routine work where quickness in changing specimens is essential. In this instrument the specimen can be exchanged and the system evacuated in a matter of minutes. Only one criticism —a minor one—can be made. The shape and size of the window are such that the eyes must be held quite close if the whole pattern is to be seen, and the screen is then rather near for comfortable vision. Suitable pumps are supplied, a variety of systems being available to suit individual needs, or a standard unit is made up ready for use. This instrument is noteworthy as it marks the entry of the diffraction camera into the industrial research laboratory, where it should yield valuable information upon metallic surface structure, to mention only one of the many possible industrial fields of investigation.

Energy obtained by Transmutation

MR. ROBERT D. POTTER, of 'Science Service', Washington, D.C., points out that the confirmation of the artificial breakdown of uranium announced in New York (see also NATURE, Feb. 11, p. 233) is in the direct succession of experiments carried out in recent years on the transmutation of the elements. For centuries, alchemists had dreamed of transmuting base metals into gold. It was imagined that enormous wealth would be at hand for the discoverer of this transmutation, and dire forecasts of the effects of this discovery were made, such as a complete revolution on the financial pattern of the world. We know that this transmutation has now been achieved for most of the known chemical elements. Transmutation's biggest result is the theoretical incentive it has provided for further physical researches. In a similar way, the dream of releasing the large amounts of energy locked inside atoms has been in the minds of men for many years. When the most efficient transformation of energy takes place in the atom of uranium so that a neutron can slip into it, the energy released is only one fifteenth of that required to bring it about. In fact, neutrons are so easily absorbed by all atomic nuclei that many of the neutrons produced with such poor efficiency will only go into atoms other than uranium. There need be little fear of an explosion in Nature due to uranium. The very heavy elements, in which such an energy release can be secured, occur only in very small amounts in the earth's crust. The release of atomic energy can only be achieved by direct experiment with this end in view and with elaborate laboratory apparatus.

Archæological Discovery near Hove

A SOMEWHAT remarkable find of traces of what would appear to be an ancient settlement is reported from the neighbourhood of Hove (*The Times*, February 20). The discovery has been made on the downs, north of Hove, where the existence of such remains had not previously been suspected. It is thought that they may be Roman, possibly of the first century A.D. The discovery was made on February 17 by a Corporation labourer who unearthed a collection of pottery, less than eighteen inches from the surface, when digging sewer trenches on a municipal housing estate. A further find was an earthenware vessel filled with about 450 small bronze coins, on some of which the head of a Roman emperor has been distinguished, but of a date not yet established. It is thought that the settlement, which overlooks Hove from the hills, may have been established about A.D. 50 and have lasted until the third century. The site is being investigated by Mr. H. G. Massey, curator of the Hove Museum, with the assistance of Dr. Cecil Curwen.

Earthquake in Bulgaria

ON February 17, an earthquake of considerable intensity was experienced at Gornadjoumaja and Sofia in western Bulgaria. At the same time a strong roaring sound was heard, and many people fled from their homes, though no serious damage or casualties are reported. The epicentre of the shock may have been about fifty miles south of Sofia, where there is the most pronounced seismic centre in Bulgaria. Between the years 1749 and 1936, 1,420 earthquakes had their epicentres in this region, and one at least had an intensity greater than 7 on the Rossi-Forel scale. The most disastrous shocks in Bulgaria in recent years were those of April 14, 17, 18, and 21, 1928, which were felt at Chirpan and Plovdiv and did more than £4,000,000 damage.

Science and Society

THE Division for the Social and International Relations of Science of the British Association is arranging a programme of meetings at which topics of immediate interest and importance will be discussed. The first of these meetings will be held on March 28 at the University of Reading, when two sessions will be devoted to a discussion on "Milk in its Nutritional and Allied Aspects". The chairmen of the sessions will be Sir Richard Gregory and Sir Daniel Hall. Other speakers will deal with deficiencies of diet, health aspects, pasteurization, production, cost, economic and social implications. It is also proposed to arrange meetings in the early summer in London and Manchester for review of the social relationships of science, and for discussion with special reference to pressing problems in industry and agriculture. In connexion with the Manchester meeting, Prof. H. Levy has been appointed to deliver the Alexander Pedler Memorial Lecture in which he will explain the method of approach in the study of the social problems of science, with particular illustrations of the application of scientific discoveries to industry. During the forthcoming meeting of the British Association in Dundee (August 30–September 6), the Division will hold three sessions when it is proposed to consider the co-ordination of scientific research, population movements and nutrition. Sir Richard Gregory, chairman of the Division, and lately editor of NATURE, will deliver an address on "Science and Social Ethics".

Musick Memorial Trophy

THE first award of the Musick Memorial Trophy of the Royal Aeronautical Society has been made to Mr. Arthur Gouge, chief designer of Messrs. Short Brothers, Ltd. The Trophy was founded in 1938 as a memorial to Captain Edwin Musick and his six companions who were lost on January 12, 1938, on the Samoan Clipper, in the South Pacific, during the first commercial flight from U.S.A. to Auckland, New Zealand. It is awarded annually to "the group, body or individual who have made the contribution, development or improvement which by its practical application has become most effective in furthering the safety of aircraft with special regard to trans-oceanic aviation". The award is confined to citizens of the British Commonwealth of Nations and the United States of America. The Trophy, in silver, is valued at £250.

The Night Sky in March

THE date of the spring equinox is March $21^d\ 12^h$ U.T. The moon is full on March 5 at 18^h and new on March 21 at 2^h. λ Geminorum (magnitude 3·6) is occulted on March 2, the disappearance taking place as seen from Greenwich at $0^h\ 23{\cdot}6^m$ at position angle 154° from the north point of the moon's disk. x Cancri, a fifth magnitude star, is occulted on March 3 at $18^h\ 23{\cdot}4^m$; 97 Tauri (mag. 5·1) is also occulted on March 26 at $18^h\ 43{\cdot}6^m$. Lunar conjunctions with the planets occur as follows: on March 13 with Mars; on March 17 with Venus; on March 22 with Mercury at 11^h and with Saturn at 17^h. Jupiter is in conjunction with the sun on March 6. Neptune is in opposition on March 13. Mercury is at greatest elongation (18° E.) on March 17. Some ten days previously it may be possible to detect this elusive planet in the evening twilight at $18\frac{1}{2}^h$ nearly due west and at 5° above the horizon. Saturn is an evening star setting at about 20^h in mid-March. Venus, a bright morning star (mag. −3·8 to −3·6), rises before 5^h, preceded by Mars, the rising of which is more than two hours earlier. Under suitable conditions, the Zodiacal Light may be seen after sunset during this month. In the middle of March, Sirius is due south about an hour after sunset. As the sky darkens, the rich assembly of bright stars west of the meridian contrasts with the sparseness of the eastern half of the sky. It is in this less spectacular region, however, that the great space-penetrating telescopes are able to record the remote extra-galactic nebulæ, of which notable clusters are in the constellations of Leo and Ursa Major.

Announcements

PROF. HENRY NORRIS RUSSELL, director of the Princeton University Observatory, has been elected *correspondant* of the Section of Astronomy of the Paris Academy of Sciences in succession to the late Prof. E. W. Brown.

MR. W. S. DAVEY has been appointed head of the Chemical Division of the Rubber Research Institute to succeed Dr. E. Rhodes, who has resigned to take up a post under the British Rubber Producers' Research Association. Mr. Davey is at present senior chemist on the staff of the London Advisory Committee for Rubber Research (Ceylon and Malaya) at the Imperial Institute.

PROF. HELMUTH SCHEEL has been appointed president and Prof. Theodor Vahlen vice-president of the Prussian Academy of Science.

THE third International Congress, under the auspices of the International Union Against Cancer, will be held in Atlantic City, New Jersey, U.S.A., on September 11–16 under the presidency of Prof. F. Carter Wood, director of the Institute of Cancer Research in Columbia University. Further information can be obtained from the Secretary-Treasurer, Dr. Donald S. Childs, 713 E. Genesee Street, Syracuse, New York.

A CONFERENCE on "China in World Affairs and Our Responsibility" is to be held in the Friends House, Euston Road, London, on March 10–11, under the auspices of the China Campaign Committee. The Conference will discuss the present position in China, economic, political and educational reconstruction in China, the rebuilding of universities, etc. Further information can be obtained from the National Organizer, China Campaign Committee, Parliament Mansions, Orchard Street, London, S.W.1.

THE Meteorological Association of the International Union of Geodesy and Geophysics will be held in Washington during September 4–15, under the presidency of Prof. S. Chapman. The subject of Prof. Chapman's address will be "Atmospheric Tides and Associated Phenomena", and the address will be followed by discussion. Other subjects for discussion will include recent developments in aerology and electric and magnetic phenomena of the atmosphere. Further information can be obtained from the General Secretary of the Assembly, Dr. J. A. Fleming, 5241 Broad Branch Road, N.W., Washington, D.C.

THE Zoological Society of London announces that, beginning with this year, its publications will be reorganized. One or more parts of the *Transactions* will appear each year and the *Proceedings* will appear in two series, as follows: (*A*) general and experimental; (*B*) systematic and morphological. These can be subscribed for either singly or in any combination. *Proceedings* (*C*) will no longer be published. In future an "Abstract and Agenda of the Scientific Meetings" will be published, and may be obtained for an annual subscription of six shillings. One volume of (*A*) and one of (*B*) will be published annually. Further information can be obtained from the Secretary, Zoological Society of London, Regent's Park, London, N.W.8.

WE regret that the price of Prof. J. D. Bernal's book "The Social Function of Science", noticed in NATURE of February 18, p. 262, was stated incorrectly to be 2*s*. 6*d*. net. The price of the volume is 12*s*. 6*d*. net.

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 337.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Disintegration of Heavy Nuclei

THROUGH the kindness of the authors I have been informed of the content of the letters[1] recently sent to the Editor of NATURE by Prof. Meitner and Dr. Frisch. In the first letter, these authors propose an interpretation of the remarkable findings of Hahn and Strassmann as indication for a new type of disintegration of heavy nuclei, consisting in a fission of the nucleus into two parts of approximately equal masses and charges with release of enormous energy. In the second letter, Dr. Frisch describes experiments in which these parts are directly detected by the very large ionization they produce. Due to the extreme importance of this discovery, I should be glad to add a few comments on the mechanism of the fission process from the point of view of the general ideas, developed in recent years, to account for the main features of the nuclear reactions hitherto observed.

According to these ideas, any nuclear reaction initiated by collisions or radiation involves as an intermediate stage the formation of a compound nucleus in which the excitation energy is distributed among the various degrees of freedom in a way resembling the thermal agitation of a solid or liquid body. The relative probabilities of the different possible courses of the reaction will therefore depend on the facility with which this energy is either released as radiation or converted into a form suited to produce the disintegration of the compound nucleus. In the case of ordinary reactions, in which the disintegration consists in the escape of a single particle, this conversion means the concentration of a large part of the energy on some particle at the surface of the nucleus, and resembles therefore the evaporation of a molecule from a liquid drop. In the case of disintegrations comparable to the division of such a drop into two droplets, it is evidently necessary, however, that the quasi-thermal distribution of energy be largely converted into some special mode of vibration of the compound nucleus involving a considerable deformation of the nuclear surface.

In both cases, the course of the disintegration may thus be said to result from a fluctuation in the statistical distribution of the energy between the various degrees of freedom of the system, the probability of occurrence of which is essentially determined by the amount of energy to be concentrated on the particular type of motion considered and by the 'temperature' corresponding to the nuclear excitation. Since the effective cross-sections for the fission phenomena for neutrons of different velocities seem to be of about the same order of magnitude as the cross-sections for ordinary nuclear reactions, we may therefore conclude that for the heaviest nuclei the deformation energy sufficient for the fission is of the same order of magnitude as the energy necessary for the escape of a single nuclear particle. For somewhat lighter nuclei, however, where only evaporation-like disintegrations have so far been observed, the former energy should be considerably larger than the binding energy of a particle.

These circumstances find their straightforward explanation in the fact, stressed by Meitner and Frisch, that the mutual repulsion between the electric charges in a nucleus will for highly charged nuclei counteract to a large extent the effect of the short-range forces between the nuclear particles in opposing a deformation of the nucleus. The nuclear problem concerned reminds us indeed in several ways of the question of the stability of a charged liquid drop, and in particular, any deformation of a nucleus, sufficiently large for its fission, may be treated approximately as a classical mechanical problem, since the corresponding amplitude must evidently be large compared with the quantum mechanical zero-point oscillations. Just this condition would in fact seem to provide an understanding of the remarkable stability of heavy nuclei in their normal state or in the states of low excitation, in spite of the large amount of energy which would be liberated by an imaginable division of such nuclei.

The continuation of the experiments on the new type of nuclear disintegrations, and above all the closer examination of the conditions for their occurrence, should certainly yield most valuable information as regards the mechanism of nuclear excitation.

N. BOHR.

At the Institute for Advanced Study,
Princeton, N.J. Jan. 20.

[1] [NATURE, **143**, 239 and 275 (1939)].

Photoactivation of Solids and its Effect on Adsorption

CONSIDERABLE attention has been given recently to chemical processes involving an activating influence of a crystal excited by irradiation[1]. The mechanism of such photosensitized reactions, although unknown in detail, is generally believed to be a more or less complete transfer of the energy absorbed by the crystal to the reacting components, physically or chemically. Accordingly, the essential difference between photosensitized processes and real photochemical ones is the distance between the place of absorption and the place of reaction. But there must also be another, more general, effect of irradiation on the activity of crystals. Due to the change in the electronic state of the particles in the lattice by the absorption of light (change in charge and degree of polarization, formation of space charges, etc.), the forces between the particles are changed and, consequently, there is also a change in potential of the

surface field that determines the chemical activity of the crystal. As in a real crystallographic transition, which causes a difference in the reactivity of the modifications under comparable experimental conditions[2], so irradiation of an absorbing crystal causes a change of the surface activity that might have a detectable influence on sorption or catalytic processes or on real chemical reactions. Naturally, in many cases, such effects would be expected to be rather small.

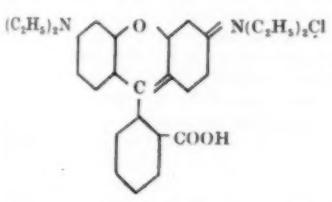
In practice, however, there will often be no possibility of deciding experimentally whether a process is photosensitized or activated as just described. But the latter must at least be the case when processes occurring at the surface of a crystal in substrates which do not absorb the irradiation are more or less quenched by irradiating the crystal. Otherwise, this influence of irradiation can scarcely be understood.

Such a phenomenon has been found in adsorption experiments with cadmium sulphide and phenolphthalein. Cadmium sulphide was shaken with an alcoholic solution of phenolphthalein for a given time with or without irradiation with white light, filtered through ferrous ammonium sulphate – quinine solutions. After centrifuging and adding sodium hydroxide the unadsorbed phenolphthalein was measured colorimetrically. The results are shown by the accompanying table.

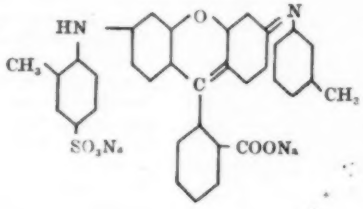
Percentage phenolphthalein adsorbed (200 mgm. CdS, 20 c.c. solution —50 mgm. phenolphthalein per litre—time of adsorption 30 minutes).

Dark	Irradiated
10·0	1·0
9·2	0·7
8·6	1·2
9·4	1·8

The decrease of the adsorbing power of cadmium sulphide by irradiation is evident. As the residual concentration of phenolphthalein is increased by irradiation, photosensitized bleaching, if it occurs, cannot cause this effect. In the irradiation experiments there has probably been a certain amount of 'dark adsorption' due to unexposed cadmium sulphide particles and to the centrifuging process. It is, therefore, possible that under suitable conditions the adsorption may be totally suppressed by irradiation of the sulphide.



(I)



(II)

Similar effects have been obtained with a large number of organic dyes, and it has been shown that an exchange of certain groups of a dyestuff molecule has a marked influence on the change of adsorption during irradiation. With the xanthene dye (I), for example, the adsorption decreased from 33 to 23 per cent during irradiation, whilst the adsorption of the dye (II) remained practically unaltered at 54 per cent. It therefore seems possible to use this effect of irradiation on the adsorbing power of solids for separation purposes.

These experiments were performed by A. Assarsson and S. Berger. We acknowledge gratefully financial assistance from the fund of the Royal Swedish Nobel Committee.

J. A. HEDVALL.
G. COHN.

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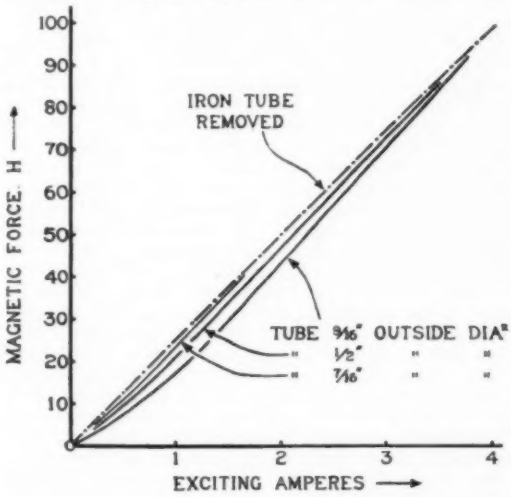
Jan. 18.

[1] See, for example, Goodeve and Kitchener, *Trans. Farad. Soc.*, **34**, 902 (1938).
[2] Hedvall, J. A., "Reaktionsfähigkeit fester Stoffe" .64 (Leipzig, 1938).

Mechanism of Magnetization

IN a previous note[1] some experimental data were recorded which indicated that one aspect of the classical theory of magnetization is incorrect. For



those experiments a solid-drawn steel tube was used, the thickness of the wall of the tube being 3/16 in., the internal diameter ⅜ in., and the length 24 in.

Further experiments have now been made for which a series of solid-drawn charcoal iron tubes were used as follows. Each tube was of internal diameter ⅜ in. and 24 in. long; the external diameters of the tubes were 9/16 in., ½ in. and 7/16 in., respectively, thus giving a thickness of wall of 3/32 in., 1/16 in. and 1/32 in., respectively. The same solenoid was used as for the previous experiments and the results of the tests are shown in the accompanying graph.

The results may be summarized as follows:

(i) The reduction of the value of H inside the tube becomes greater as the thickness of the wall increases.

(ii) The reduction of H within the tube is a maximum when the tube is magnetized to a condition which about corresponds to the knee of the magnetization curve.

(iii) When the tube is magnetized to a condition

of saturation, the value of H within the tube is practically unaffected by the material of the tube. The results also show that the self-demagnetizing effect of the ends of each tube is negligibly small.

These test data support the view formulated in a previous[2] note, namely, that the magnetization of a material is initiated at the surface and proceeds inwards by a kind of 'chain effect', so that the flux density near the surface is a maximum and becomes progressively less as the distance from the surface increases.

A comprehensive account of these investigations is now being prepared and will be published shortly.

T. F. WALL.

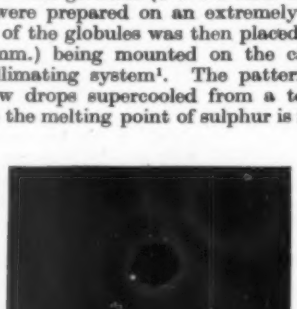
Department of Electrical Engineering,
University, Sheffield, 1.
Jan. 9.

[1] NATURE, 141, 1039 (1938).
[2] NATURE, 142, 875 (1938).

X-Ray Diffraction by Supercooled Liquid Sulphur

IT has been observed that sulphur may be kept, with a little care, in the supercooled liquid state at the ordinary room temperatures (25°–30° C.) in the form of small globules on clean glass surfaces. In some cases it has been possible to keep one and the same globule in the supercooled state for more than three days, even under X-ray exposures. Supercooled liquid sulphur may be prepared also on metal surfaces, for example, brass, aluminium, etc., but in those cases it becomes unstable and solidifies easily, probably due to the crystallizing forces exerted by the metal surfaces. Again, under given physical conditions, the stability is found to be a function of the size or the diameter of the drops. The greater the diameter, the less is the stability. This is probably due to larger surfaces or volumes being more liable to get disturbed. The drops in the supercooled state are found to retain the colour they had at higher temperatures before cooling. Hence it is supposed that the drops maintain exactly the same physical state as they had at the higher temperatures.

X-ray diffraction photographs of supercooled liquid drops have been taken by the transmission method. Taking the factors of high absorption by sulphur of the copper $K\alpha$ radiation used in the experiment and also the stability of the supercooled drops into consideration, small globules (0·3–0·5 mm. in diameter) of liquid were prepared on an extremely thin glass film. One of the globules was then placed before the slit (0·4 mm.) being mounted on the carrier of a special collimating system[1]. The pattern obtained with yellow drops supercooled from a temperature just above the melting point of sulphur is reproduced herewith. The single band recorded in the photograph corresponds to a Bragg-spacing which agrees well with those observed by Blatchford[2] and by Das[1] in the case of liquid sulphur maintained at higher temperatures above the melting point. The accompanying table brings together all the results.



X-RAY DIFFRACTION PHOTOGRAPH OF SUPERCOOLED SULPHUR.

BRAGG-SPACING OF LIQUID SULPHUR.

Author	Temperature	Spacing ($\times 10^{-8}$ cm.)
Blatchford[2]	130° C.	3·68 ± 0·01
Das[1]	128° C.	3·76 ± 0·02*
Das and Das Gupta	27° C. (supercooled)	3·68 ± 0·02

* This new value of the spacing is yet unpublished. According to Das, it is more accurate than that reported by him previously[1] and than that of Blatchford[2].

It is interesting to note that the spacing at 128° C. is larger than that at 27° C. This is evidently due to the thermal expansion of the liquid with rise of temperature.

The study of a liquid in the supercooled state by X-ray diffraction has not, hitherto, been reported. The results of further investigations, now in progress, by X-ray and other methods will be published elsewhere; they may be expected to throw much light on the supercooled liquid state of matter in relation to the ordinary liquid and the solid states.

S. R. DAS.
K. DAS GUPTA.

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University College of Science,
Calcutta.
Jan. 21.

[1] Das, *Ind. J. Phys.*, **12**, 163 (1938).
[2] Blatchford, *Proc. Phys. Soc.*, **45**, 493 (1933).

Structure of the $SnCl_4^{--}$ Group

IN a letter in NATURE[1], Cox, Shorter and Wardlaw examined the stereochemistry of bivalent tin and lead and arrived at conclusions which are not in agreement with some of our results.

The compound $K_2SnCl_4.2H_2O$, which is described as being orthorhombic with $a = 12{\cdot}02$, $b = 9{\cdot}11$ and $c = 8{\cdot}23$ A., and the space-group $Pnma$, has been studied quite recently in our laboratories and the results so far obtained, although they lead to the same unit cell and space-group, do not suggest that the $SnCl_4^{--}$ group is co-planar.

The actual formula of potassium chlorostannite is worth consideration. Rammelsberg[3] and others[3,4] found only one water molecule of hydration, while Richardson[5] later obtained two water molecules. A thorough study of the dehydration of hydrated potassium chlorostannite gave strong evidence for the existence of only one water molecule in the compound, in agreement with Rammelsberg's results. Moreover, the calculation of the number of molecules contained in the unit cell (density[4], 2·514) leads to 3·88 of $K_2SnCl_4.H_2O$ and to only 3·68 of $K_2SnCl_4.2H_2O$, the difference between this number and 4 being due partly to the over-evaluated amount of water.

A Fourier-Patterson-Harker and a Fourier-Bragg diagram suggested a structure which is almost identical with that found by MacGillavry, de Wilde and Bijvoet[7] for $K_2HgCl_4.H_2O$. Thus the $SnCl_4^{--}$ groups are obtained from octahedral $SnCl_6$ groups sharing edges parallel to the (010) plane and forming columns of so-called 'rutile octahedra' in the direction of the b axis.

In conclusion, may we suggest that the *a*, *b*, *c* axes, as chosen by Cox, Shorter and Wardlaw, be called *b*, *c* and *a*, in accordance with the usual convention.

H. BRASSEUR.
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Institut de minéralogie et
Institut W. Spring,
Université de Liége.
Jan. 18.

[1] Cox, E. G., Shorter, A. J., and Wardlaw, W., NATURE, **139**, 71 (1937).
[2] Rammelsberg, C. F., *Kryst. Chemie*, 208 (1855).
[3] de Marignac, Ch., *Ann. des Mines*, (5), 12–16 (1857).
[4] Streng, A., *Neues Jahrbuch für Miner.*, **2**, 142 (1882).
[5] Richardson, *Amer. Chem. J.*, **14**, 89 (1892).
[6] Groth, P., "Chemische Krystallographie", **1**, 356.
[7] MacGillavry, C. H., de Wilde, J. H., and Bijvoet, J. U., *Z. Krist.*, A, **100**, 212 (1938).

Direct Perception of Pigment in the Nerve Tissue of Human Retina

DURING spectroscopic study of a flavoprotein compound in heart muscle preparation, it was noticed that two diffuse absorption bands of the pigment remained always perceptible, however dilute was the preparation or thin the layer examined. Further observations have revealed that these two bands remain perceptible even in the absence of muscle preparations. Moreover, examination with a small dispersion spectroscope of any source of artificial light shows the presence of two diffuse absorption bands lying at about 495 mμ and 455 mμ. The first band is more distinctly visible at a lower intensity of light, while the second band can be more easily perceived when the light passes through a suitable filter such as a solution of ammoniacal copper sulphate or Wratten filter D.

In order to see these bands, it is essential to use a very low dispersion spectroscope such as a micro-spectroscope ocular attached to a microscope or a prism pocket spectroscope and a source of light giving a continuous spectrum. The relative intensities and positions of these bands remain constant and are independent of either the optical system or the source of light. This clearly indicates that the absorption bands are not due to the instruments but to a substance present in the observer's eye and lying on the path of rays from the light source to the sensitive portion of the retina. As the cornea, lens, aqueous and vitreous fluids are devoid of any perceptible colouring matter, the pigment responsible for the absorption bands must be present in the retina itself, in the nerve tissue lying in front of the visual cells (cones) and most probably in the *macula lutea* and *fovea centralis*.

The presence of this pigment in the retina can also be deduced from an examination of the visibility data obtained in the 'step-by-step' matching of the intensities of two adjacent spectral regions. In every case these data, whether for normal[1,2] or for the colour-blind[3] eye, reveal two distinct depressions in the visibility curve. These two depressions, ascribed[2] to a pigment present probably in the optical path of the eye, lie at about 495 mμ and 455 mμ, occupying therefore the same positions as the absorption bands described above.

As to the nature of this pigment, we can suggest only that it may be either a flavin or a carotinoid compound, or possibly a mixture of both and present in the thin layer of nerve tissue of the macula in a concentration sufficiently high to give a perceptible absorption spectrum. In fact, flavin and its derivatives[4] as well as β-carotene[5] have been obtained from ox retina. Both pigments have somewhat similar absorption in the region of the spectrum occupied by the above bands. However, the exact nature of the substance responsible for the perception of these two absorption bands will only be solved by a careful study of the pigments obtained directly from the *macula lutea* of the human eye.

The two absorption bands described above represent, so far, the only slight discontinuities which the eye can perceive in the otherwise continuous spectrum of an artificial source of light. They denote only a very slight imperfection in the eye caused by the presence of pigments in the nerve tissue of the retina itself, an imperfection which is highly magnified by the use of a small dispersion spectroscope.

This observation also serves as warning against the use of the direct method of spectroscopic examination in the general survey of flavin or carotene distribution in different tissues and their extracts. In fact, if this method is used, it will not be possible to detect any cells completely devoid of these pigments.

D. KEILIN.
E. L. SMITH.
(Guggenheim Fellow).

Molteno Institute,
University of Cambridge.
Feb. 1.

[1] Gibson, K. S., and Tyndall, E. P. T., *Bur. Stand. Sci. Papers*, **19** 131 (1923).
Fedorow, N. T., and Fedorowa, W. I., *C.R. Acad. Sci., U.R.S.S.* **2**, 377 (1936).
[2] Hecht, S., and Shlaer, S., *J. Gen. Physiol.*, **20**, 57 (1936).
[4] Brunner, O., and Baroni, E., *Sitzber. Akad. Wiss. Wien*, Math. natw. Klasse, IIC., **145**, 484 (1936).
Brunner, O., Baroni, E., and Kleinau, W., *Z. physiol. Chem.*, **236**, 257 (1935).

Differentiation of Disaccharide-splitting Enzymes

WEIDENHAGEN'S theory of the specificity of glucosidases and disaccharases[1], as opposed to the theory of specificity of Leibowitz[2], depends largely upon the claim that the maltose-splitting factor of taka-diatase is an alpha-glucosidase identical with the sucrose-splitting factor (glucosucrase). According to Leibowitz, on the other hand, taka-maltase is a specific glucomaltase, inert to alpha-methyl-glucoside and distinct from the taka-sucrase.

Recently[3] we reported the possibility of freeing taka-maltase from accidentally accompanying alpha-methyl-glucoside splitting enzyme on the basis of the thermostability of the former. It has now been found that on brief incubation at *p*H 3·5 the heat-stable taka-maltase retains full activity whilst taka-sucrase is completely destroyed. Hence it follows that taka-maltase and taka-sucrase are two distinct enzymes. Consequently, the theory of Weidenhagen, against which serious objections have already been raised, may now be considered refuted.

J. LEIBOWITZ.
S. HESTRIN.

Department of Hygiene and
Bacteriology,
Hebrew University,
Jerusalem.
Jan. 22.

[1] Weidenhagen, "Ergebnisse der Enzymforschung", vol. 1 (1932): *Z. physiol. Chem.*, **216**, 255 (1933), and elsewhere.
[2] Leibowitz, *Z. physiol. Chem.*, **149**, 184 (1925); Leibowitz and Mechlinsky, *ibid.*, **154**, 64 (1926).
[3] Leibowitz and Hestrin, NATURE, **141**, 552 (1938).

Reduction of Heart Flavoprotein

WE recently described[1] the catalytic properties of a flavoprotein isolated from heart. At that time we were unable to observe the reduction of flavoprotein by reduced coenzyme I. We now find that, by eliminating coloured impurities in the various components of the catalytic system, the rapid reduction of flavoprotein to its leuco form can be readily demonstrated. Under the conditions of our experiment, the leuco form is non-autoxidizable but can be oxidized by 'carriers' such as methylene blue. The mechanism of the catalytic effect of heart flavoprotein involves a cycle of reduction by reduced coenzyme I and oxidation of the leuco form by some suitable 'carrier'.

F. B. STRAUB.
H. S. CORRAN.
D. E. GREEN.

Molteno and Biochemical Institutes,
Cambridge.
Feb. 7.

[1] Straub, Corran and Green, NATURE, **143**, 119 (1939).

Relative Sexuality in Unicellular Algæ

IN a series of papers, Dr. Franz Moewus, working first at the Kaiser Wilhelm Institut für Biologie in Berlin, and later at Erlangen and Heidelberg, has published a number of very remarkable results on relative sexuality in unicellular algæ. The qualitative results are in agreement with those of other workers of the same school. We wish, however, to direct attention to a feature of his quantitative data which casts grave doubt on their reliability.

Moewus' last paper[1] described the genetical behaviour of various races of *Chlamydomonas eugametos*. The zygotes derived from crosses within dicecious races, that is, races with genotypical sex-determination, are said to give 3·08 per cent exceptional gametes. Clones grown from these exceptional gametes can produce gametes of both sexes, that is, they show phenotypical sex-determination. These abnormal segregations are ascribed to crossing over between the two non-allelomorphic sex determiners. In each of the crosses 1–9, 18–34, and 37–40 he tested 500, or occasionally 400 or 300 zygotes. In 27 of the 31 crosses, 500 zygotes were tested, and the number of exceptions was between 13 and 17 in every case.

Struck by this astonishing consistency, we applied Pearson's χ^2 test to all 31 crosses, and found $\chi^2 = 2{\cdot}423$ for thirty degrees of freedom. The probability of obtaining as bad or worse a fit by sampling is $P = 1 - 4{\cdot}7 \times 10^{-13}$. That is to say, only once in about 10^{11} trials would so good a fit be obtained by chance. In the same paper (Table 7) Moewus once more calculates the above "cross-over" value from four samples of 5,000 zygotes each, by observing the number of cells dying as a result of meiosis. The numbers are 152, 158, 151, and 155, forming exactly 3·08 per cent of the total, as before. We can therefore add the total value of χ^2 obtained from them, namely, 0·201 for four more degrees of freedom, to the former value, obtaining a grand total of $\chi^2 = 2{\cdot}624$ for thirty-four degrees. This gives $P = 1 - 6{\cdot}6 \times 10^{-14}$.

A second suggested cross-over frequency between the male determiner *M* and the gene *t* for *Subheteræcie* amounting to 9·8 per cent is deduced from six crosses (numbers 36–39 and 42–43). Here $\chi^2 = 0{\cdot}0410$ for five degrees of freedom. So $P = 1 - 6{\cdot}3 \times 10^{-4}$ approximately, though even Sheppard's table of the probability integral is not accurate enough to give the second significant figure with certainty.

Nor is the truly remarkable agreement between theory and observation confined to the paper in question. In a paper[2] on *Protosiphon botryoides*, Tables 2, 3, and 4 record twenty-two experiments in which the cultures segregated into approximately equal numbers. Either the two halves gave different kinds of gamete or one gave gametes and the other did not. In eleven experiments where thirty cultures were counted, the deviation from equality never exceeded 17 and 13. In eleven experiments where ten cultures were counted, the largest deviation is 6 and 4. For twenty-two degrees of freedom $\chi^2 = 5{\cdot}06$, $P = 1 - 6{\cdot}9 \times 10^{-5}$.

So good a general agreement with theory would be obtained by chance once in $3{\cdot}5 \times 10^{22}$ trials; that is to say, if every member of the human race conducted a set of experiments of this type daily, they might reasonably hope for such a success once in fifty thousand million years. There are two alternatives to the hypothesis of chance. One is that a wholly new type of biological regulation has been unwittingly discovered, by which the frequency of segregation is controlled with extreme sharpness, and that this applies to three segregations in two species. The other is that the author has consciously or unconsciously adjusted his observations to fit his theory. As this work is of fundamental importance for the theory of sex-determination, it is desirable that these experiments should be repeated by an independent observer. Until this is done, those parts of Dr. Moewus' genetical theory which are based on these numbers cannot, we think, be accepted.

U. PHILIP.
J. B. S. HALDANE.

Department of Biometry,
University College,
London. Jan. 25.

[1] *Biol. Zbl.*, **58**, 516–536 (1938).
[2] *Biol. Zbl.*, **55**, 293–309 (1935).

Embryology of the Symphyla

OWING to the significance which is attached to the Symphyla in speculations on the origin of insects, a knowledge of their embryology has become desirable. Having recently obtained, in large quantity, the eggs of a local species of *Hanseniella*, I have been able to work out a fairly complete story of the development of these remarkable animals. A detailed account of this will be published later; the present note records a few points which are significant on phylogenetic grounds.

Cleavage is total, as in Collembola and some Diplopoda. By tangential division of the large yolk-pyramids, an outer layer of small cells and an inner layer of very large cells arises, both rich in yolk. From the former arises the blastoderm. From the latter arises by further division the internal mass of yolk-cells. These are not pure vitellophages, however, for from them develop the fat-body and mid-gut epithelium.

An embryonic area forms by ventral thickening of the blastoderm. A precocious flexure then forms in the embryonic area, as in some diplopods[1], and thereby the germ-band becomes defined. A 'dorsal organ' is present; but there are no embryonic membranes.

The mesoderm arises by bilateral separation of cells from the germ-band. Segmentation of the mesoderm into somites synchronizes roughly with external segmentation of the germ-band. In the head there is no external sign of segmentation. The labial segment arises as part of the abdomen. Behind it are formed seven leg-bearing segments, followed by a pre-anal segment, the appendages of which are the cerci. On the anal segment appendages are vestigial.

In the head, six pairs of coelomic cavities form; each abdominal segment is furnished with a single pair of coelomic sacs. The antennary and pre-antennary coelomic sacs co-operate to form the aorta. The coelomic sacs, from the mandibular backwards, grow through the yolk-cells, enclosing part of these as mid-gut epithelium; they all furnish cardioblasts for the heart. The pre-mandibular coelomic sac undergoes a remarkable development, for from it arises a large excretory gland which degenerates at the time of eclosion; in association with it is a clump of nephrocytes, probably homologous with the sub-œsophageal bodies of insects. The salivary gland is a remnant of the maxillary coelomic sac.

Great significance is naturally attached to the reproductive organs. The genital tubes arise by concrescence of the vestiges of the coelomic sacs from the fourth abdominal to pre-anal segments. Vestigial coelomoducts survive in the pre-anal segment until after eclosion, the larva presenting the appearance of a potentially opisthogoneate rather than progoneate myriapod.

The most noteworthy feature of the nervous system is the development of its ganglia in association with 'ventral organs' as in *Peripatus*. The 'ventral organs' retrogress; from the remnants arise the eversible sacs.

The Symphyla appear to be the survivors of a very ancient stock of myriapods, closely related to the opisthogoneate forms from which the insects were derived, but already distinguished by the acquisition of a secondary anterior genital opening, which the diplopods have inherited from them.

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Jan. 3.

[1] Metschnikoff, E., *Z. Wiss. Zool.*, **24** (1874).

Studies on *Chironomus* Chromosomes with the Polarizing Microscope

IN previous communications[1] it was pointed out that in protoplasm there are linear units forming either a brush heap of fibrils or having a symmetrical arrangement of them oriented end-on-end in parallel rows. Furthermore, it has been shown[2] that, during the appearance of mitotic spindle fibrils, living matter possesses a continuity in structure which only fibrous units can adequately impart to it. In D. M. Wrinch's model[3], a chromosome has been pictured as consisting of a net of polypeptide molecules in parallel forming the warp of the fabric, and of nucleic acid molecules constituting the woof. In my opinion, Wrinch's assumption of fibrillar units offers several possibilities, especially in regard to the postulates of genetics and to the findings of the cytologists as to the capacity of the chromosomes to swell, to contract, to grow, and to divide. On the other hand, it is known[4] that fibrils of nucleic acid are optically negative and run parallel with the axis of sperm heads.

It is the purpose of this note to indicate the essential features of a chromosome model of polypeptide chains in parallel with nucleic acid molecules. Salivary glands of a *Chironomus* sp. were selected from female larvæ preparing to pupate. Slight pressure on the salivary gland nuclei not only separates the chromosomes from each other but also reveals most strikingly, at the same time, the chromomeric, banded nature of the heterochromatin[5]. It is true, H. Bauer in 1935 failed to find anisotropy in chromosomes of salivary glands even in a stretched state; but H. Ullrich in 1936 emphasized the fact that the chromomeric bands are doubly refractive after injury. When the chromosomes are pressed out into a favourable medium, for example, paraffin oil, the double-refraction of the transverse bands is, though often weak, nearly always capable of verification. Furthermore, it becomes pronounced when the chromosomes are intensively extended between two micro-needles as used by P. Vonwiller and A. Audova. After cessation of stretching, the chromosomes contract without attaining their initial length.

It has occurred to me that these contractions may be due to the shortening of protein fibrils by molecular folding or helical contraction as postulated by W. T. Astbury[6] for wool and hair. Along with the lengthening, the chromosome becomes less transparent in the interchromomeric bands, and the anisotropy measured in Γ-values often increases considerably. But the extended chromosomes are always negatively birefringent with respect to their long axis. So I see no reason for the assumption of a cross-arrangement of nucleic acid molecules, but I assume the same direction of both the polypeptide chains and the nucleic acid molecules. The nucleic acid bands may form zones of alternating density along the micelle'. With regard to the chromosome micelle, my agreement with Wrinch consists in the assumption of a contractility and of swelling properties in comparison with which those of the coarse animal fibrils vanish into insignificance.

Our knowledge of the molecular structure of the chromosome micelles is slight compared with the knowledge of the structure of materials like cellulose or other derivatives of protoplasm. Further work is now in progress on some points raised by these experiments, and will be reported in due course.

HANS H. PFEIFFER.

Kolonial- u. Uebersee-Museum,
Bremen. Jan. 10.

[1] Pfeiffer, H. H., NATURE, **133**, 1054 (1936); *Physics*, **7**, 302 (1936); Fujii Jubil. Vol. (Tokyo), 701 (1937); Frey-Wyssling, A., "Submikroskopische Morphologie des Protoplasmas und seiner Derivate", p. 73 (Berlin: Gebr. Borntraeger, 1938).

[2] Pfeiffer, H. H., NATURE, **140**, 770 (1937); *Biodynamica*, No. 35 (1938); Verh. V. intern. Zellf.-Kongr. Zürich, 257 (Jena: G. Fischer, 1939).

[3] Wrinch, D. M., NATURE, **134**, 978 (1934); Proc. Intern. Bot. Congr. Amsterdam, **2**, 24 (1935); *Protoplasma*, **25**, 550 (1936).

[4] Schmidt, W. J., *Zool. Jahrb.*, **45**, 177 (1928); "Die Doppelbrechung von Karyoplasma, Zytoplasma und Metaplasma", 81 (Berlin: Gebr. Borntraeger, 1937); Pattri, H. O. E., *Z. Zellf.*, **16**, 723 (1932); Frey-Wyssling, *loc. cit.*, 184.

[5] For a general introduction to the properties of the chromosomes of salivary glands of Diptera, see Darlington, C. D., "Recent Advances in Cytology", second edit., p. 175 (London: J. and A. Churchill, 1937); Bauer, Hans, in Hartmann, M., *Fortschr. Zool.*, **1**, 6; **2**, 11 (Jena: G. Fischer, 1937); Geitler, L., "Chromosomenbau", 99-103 (Berlin: Gebr. Borntraeger, 1938); for the method of preparation: Heilborn, O., *Ann. Agr. Coll. Sweden*, **4**, 89 (1937).

[6] Astbury, W. T., "Fundamentals of Fibre Structure", 146 (London: Oxford Univ. Press, 1933); together with Street, A., Woods, H. J., and Sisson, W. A., *Phil. Trans. Roy. Soc.*, A, **230**, 75 (1931); **232**, 333 (1933); *Proc. Roy. Soc.*, A, **150**, 533 (1935); **166**, 76 (1938); Seifriz, W., *Science*, **88**, 21 (1938).

Cf. Astbury and Bell, Florence O., NATURE, **141**, 747 (1938).

Food of Salmon Parr

AN investigation of the stomach contents of salmon parr from the River Dee and its tributaries has been in process during the past twelve months, and, in view of the scarcity of published data on this subject, a preliminary note may be of general interest.

The feeding is totally indiscriminate, and a single meal may include representatives of a dozen or more species of animals taken at random from under stones (insect-larvæ), free water (Cladocera and small beetles), or surface-driftage (aerial and terrestrial arthropods), while the large number of dipteran flies (especially Empididæ and Mycetophilidæ), uniform in species, sometimes found within a single stomach suggests that the fish may have snapped at swarms in the air itself.

Until so late as the end of October, food organisms of sub-aerial origin are more numerous than aquatic types in the stomachs, and the numerical abundance of Hemipteran plant pests, especially those associated with the alder (some species of *Psylla* and of Cicidina), points clearly to the desirability of encouraging the growth of trees and shrubs along the banks of the streams, especially where the benthic fauna is poor.

Details of the full seasonal cycle and a list of food organisms will be published later.

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Jan. 16.

Ancient Egyptian Astronomy

WITH reference to Dr. O. Neugebauer's letter in NATURE of January 21, p. 115, on this subject, may I express concurrence in respect to the neglect of this matter? Whereas excellent work has been done by Daressy, Schott, Gundel and Zinner on the Continent and by A. Pogo in America, very little attention is being given to it in England.

The Stobart tables, to which Dr. Neugebauer refers, can, however, never be quite forgotten, since it was by them that Brugsch definitely identified the planets in the astronomical ceilings of the temples of Denderah and Edfu (Roman period), the two temples of Esneh (Ptolemaic period), the temple of Medinet Habu, the Ramesseum and the tomb of Seti I (New Kingdom). Similar identifications of the planets have since been made on the Karnak clepsydra (Amenophis III) and on the Senmut ceiling (Hatshepsut, say, 1500 B.C.) and by Daressy on a Tenth Dynasty coffin from Asiut (say, 2000 B.C.). Venus may perhaps be referred to in the Fifth and Sixth Dynasty Pyramid texts (say, 2500 B.C.). Recently I noticed the planets in the coffin of Heru-netch-tef-ef in the British Museum (about 350 B.C.).

The standard "schaema coeli" appears to have been developed about the beginning of the New Kingdom (say, 1600 B.C.) and consists normally of three registers, containing (1) the 36 dekans, Sirius, the superior planets, the "meta-dekans" and the inferior planets; (2) the northern stars; (3) the twelve monthly feasts.

In the preceding Middle Kingdom (say, 2000 B.C.), the scheme is simply one of four figures: the Goddess of Heaven, the Great Bear (Ox-leg), Sirius and Orion.

The Pyramid texts contain numerous references to Sirius and Orion.

Pogo[1] has studied the tables of dekanal stars and hours on the Asiut Tenth Dynasty coffins, and it is clear that, at that era, the Egyptian notions of time were most vague, and similarly the Eighteenth Dynasty Karnak clepsydra is by no means accurate. Even the table of dekans was never standardized, but differs from dynasty to dynasty.

It seems very doubtful if one can safely attribute much mathematical ability to the ancient Egyptians on the basis of the demotic texts to which Dr. Neugebauer refers. From the time of the foundation of the Museum at Alexandria, Greek methods appear to have been adopted. The Denderah planisphere shows that the essential features of purely Greek astrology had been incorporated into the Egyptian system in Roman times, and even the "ancients" (Petosiris and Nechepso), so frequently alluded to by classical writers, seem to have acquired many notions from the Greeks, if one may judge by the fragments of their lore contained in the writings of Firmicus.

For those who are interested, I may remark that the replica of the Karnak clepsydra in the Science Museum at South Kensington shows most of the features of the standard figure of heaven, and agrees in most respects with the oldest existing example, that from the ceiling of the tomb of Senmut.

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[1] *Isis*, 17, 6 (1932); *Osiris*, 1, 500 (1936); and in Gundel's "Dekane und Dekansternbilder" (1936).

Finance for Scientific Research

I SHOULD like to comment on the leading article in NATURE of January 28 on this subject.

I think that the best hope lies in approaching this matter in a truly scientific spirit, when the authorities, it is to be hoped, would not feel in duty bound to defend the present position nor would reformers require to attack it. Research associations were originally formed, with Government help, to introduce research into various industries, and there was a belief that the advantages of research to the industries would become so apparent that after a period industries would provide all the funds for research themselves.

In general, the industries have become convinced of the advantages of research, but their prosperity and hence their ability to finance research has been impaired by circumstances affecting their supplies of raw material and their markets at home and abroad, which have been beyond the influence of the research associations.

Research associations are supposed to confine themselves to research on the processes of their members and leave these other matters alone. In my experience, this limitation cuts off a most important field of research, and tends to preclude any large advance of economic importance. In many cases, certainly in textiles, a large part of the price of the finished article consists of the price paid for the raw material. Unless and until attention is paid to ensuring ample supplies of uniform quality and reasonable price, no amount of research upon processes will overcome the difficulties of British industry.

Again, a research association cannot undertake research to develop entirely new uses for its raw material outside existing channels, because it is working for members who are operating established

processes. It seems to me that many notable advances depend on using some raw material in a new way, such as using rubber for tyres instead of rubbing out pencil marks. By neglecting to finance this kind of research, are we not leaving the most fruitful field without fertilizer ?

From the financial point of view, the main expenditure on research is on the salaries and wages of the research workers. At present, there are glaring irregularities owing to differences in organization and finance. Scientific workers in universities are in permanent positions; but they are paid for their educational services rather than for research. Scientific workers in the many Government establishments are in permanent establishments and are paid upon recognized salary scales to do research. Scientific workers in the employ of private firms are likely to have a permanent career and prospects if the firm is sufficiently stable, and they may be paid to some extent by results. At present, the position of scientific workers in research associations is the least satisfactory. The continuance of their employment is only reasonably assured over the quinquennial period for which Government grants are arranged. My experience, which may be usual, is that young people join the staff to gain valuable experience of industrial research, and seek an assured career in a Government research station, where a better salary and prospects are open to them, or they leave to enter private employment in industry.

This means that co-operative research undertaken by an industry and partly paid for by the industry is at a disadvantage in retaining an experienced staff, compared with an industry, which for some reason or other pays nothing towards co-operative research, either getting it done by a Government establishment or relying on individual and private effort. This is neither just nor advisable. Co-ordination of research effort all along the line is necessary, and research workers should choose their field because they are attracted to it, not because it offers the best opportunities of a career.

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Points from Foregoing Letters

PROF. N. BOHR, discussing the recent observations on the break up of certain heavy nuclei when bombarded with neutrons into particles of approximately equal size, suggests that this effect might be treated approximately as a classical mechanical problem, on the assumption that the excitation energy is distributed among the various degrees of freedom in a way resembling the thermal agitation of a solid or liquid body. The usual radioactive phenomena would then be analogous to the evaporation of a molecule from a liquid drop.

Experiments reported by Prof. J. A. Hedvall and Dr. G. Cohn indicate that the adsorption of phenolphthalein (in alcoholic solution) by cadmium sulphide, is reduced when the latter is activated by irradiation with white light. A similar effect has been obtained with various organic dyes.

Further experiments by Dr. T. F. Wall show that in iron tubes the reduction in the value of H inside the tube becomes greater as the thickness of the wall increases, and is a maximum when the tube is magnetized to a condition which about corresponds to the knee of the magnetization curve. This, he states, supports the views previously formulated that one aspect of the classical theory of magnetization is incorrect, and that the magnetization of a material is initiated at the surface and is transmitted inwards by a kind of 'chain effect'.

An X-ray diffraction photograph of a drop of supercooled liquid sulphur at 25–30° C. is submitted by S. R. Das and K. Das Gupta, who point out that the study of supercooled liquids by X-rays has not hitherto been reported.

X-ray studies of potassium chloroplatinate crystals lead H. Brasseur and A. de Rassenfosse to the view that the $SnCl_4^{--}$ group is not co-planar. In other respects (that is, size of unit cell and space-group), their findings agree with those of Cox, Shorter and Wardlaw.

By examining with a very low dispersion spectroscope any source of artificial light giving a continuous spectrum, it is possible, according to Prof. D. Keilin and Dr. E. L. Smith, to observe two diffuse absorption bands at about 495 and 455 mμ. These, they state, are due to a pigment in the retina which may be either a flavin or a carotinoid compound, or possibly a mixture of both.

At *p*H 3·5, taka-maltase is stable, but taka-sucrase is quickly destroyed. Hence, according to Dr. J. Leibowitz and S. Hestrin, these two are distinct enzymes.

Discussing results obtained by Dr. T. Moewus in his genetical experiments with unicellular algæ, U. Philip and Prof. J. B. S. Haldane find that the probability of their occurrence is so low that one must assume that either a new type of biological regulation is involved or that the author has consciously or unconsciously adjusted his observations to fit his theory.

Dr. O. W. Tiegs describes the development of the embryo of the Australian arthropod *Hanseniella*. It indicates that the Symphyla, the insect class to which it belongs, are survivors of a very ancient stock of myriapods distinguished by the acquisition of a secondary anterior genital opening.

From observations of the chromosomes of salivary gland nuclei of *Chironomus*, pressed out into paraffin oil, Dr. H. H. Pfeiffer concludes that they show definite double refraction of the transverse bands, particularly when stretched. The author considers that Dr. Wrinch's model of net-structure offers interesting possibilities of explaining the contractile and swelling properties of the chromosomes.

Research Items

Early Bronze Age in Wessex

MR. STUART PIGGOTT has examined evidence belonging to the final phase of the Early Bronze Age culture of Wessex with the view of establishing the existence of a culture corresponding chronologically with the food-vessel phase of northern England, and intervening, in a ceramic sense, between the beaker and cinerary urn, and forming a final phase in the Early Bronze Age (*Proc. Prehist. Soc.*, N.S., **4**, 1; 1938). Such a phase had been postulated in the typological series of bronze implements, while for a great many years a remarkable series of grave groups has been known, incorporating elements (often spectacular in their implication of material wealth), which are peculiar to the area. Obviously they throw a great deal of light on trade relations both internal and overseas. Analysis of the archæological evidence points to an intrusive culture with types divisible into two groups, those of a southern (maritime) origin and those whose affinities suggest early entry overland from the north. In the first category are bronze daggers with mid ribs and/or lateral grooves, certain pottery forms, notably incense cups, beads of blue faience, now established as of Egyptian origin; and in the second group gold ornaments of Irish origin, and beads and pendants, stone battle-axes of the Snowshill type, pins of Germanic type, and perhaps flanged axes. With the two groups are certain exceptional objects. We are thus faced at the end of the beaker phase with the sudden flowering of a true bronze age, marked by an opening up of trade connexions all over Europe, and the appearance of new types of weapons, tools and ornaments, and a radical change in burial rites. Such a change cannot have taken place without external stimulus, so radical that it cannot have been brought about except by actual settlement—a wave of prehistoric migration from Brittany, a dominant and intrusive aristocracy, who lorded it over a basic folk-culture of food-vessel type, which, however, ultimately absorbed it.

Secret Societies of Sierra Leone

A PRELIMINARY report on the expedition of the University Museum, Philadelphia, to West Africa in 1937 ("The Sherbro of Sierra Leone" by H. U. Hall. Pp. 52 with map. Philadelphia: The University Press, 1938) includes among other matters a description of the place and function of the various secret societies among the Sherbro, or Bolom, of Sherbro Island and the chiefdom of Shenge (Kagboro), in which the old Sherbro culture is best preserved. The population of the island is estimated at 15,571, this figure including 1100 Mendi; while Shenge chiefdom is estimated to have a population of about 15,200. Sherbro Island consists of two chiefdoms, over each of which is a paramount chief, chosen from ruling 'houses' or *rams*, exogamous units composed of blood-relations, in some of which patrilineal descent now prevails. The matter of succession by descent figures not only in regard to rulership, but also in the matter of the organization of the more important secret societies, one of which, *Poro*, was formerly a powerful instrument of government. Secret societies still play a very significant part in Sherbro life. A man who does not belong to *Poro*, or the third society intrusive *Thoma*, has no standing in the community. Membership of the women's society, *Bundu*, is also obligatory for women. *Poro* is exclusively for men, but *Thoma* is a mixed society, as is also the *Ntundung* society among the people of the Ndema chiefdom. *Poro* is now "put in the bush" about once in three or four years, the bush being a grove of large cotton trees, which, though not enclosed, is strictly barred to women and non-members. When *Poro* is in session the *Poro* "devil eats" the candidates, who are seized *pro forma* if willing, and violently if not willing. This is a ceremonial death through which the candidate enters the world of the spirits of the ancestors. Emergence from the bush at the end of the period of initiation is the equivalent of resurrection, or rather a new birth, brought about by "beating the devil's belly" until he vomits the candidates he has swallowed. In former times decisions affecting the affairs of a chiefdom, both internally and in relation to other chiefdoms, were all taken in the *Poro* council.

Distribution of Vitamins A_1 and A_2

G. WALD (*J. Gen. Physiol.*, **22**, 391; 1938) has examined the distribution of vitamins A_1 and A_2 in the eye tissues and livers of freshwater and marine fishes by means of the antimony chloride reaction, which yields with A_1 a band at 615–620 mμ and with A_2 a band at about 696 mμ. In the retina the presence of vitamin A_1 is diagnostic of the operation of a rhodopsin and vitamin A_2 of a porphyropsin cycle. The eye tissues of all permanently marine fishes examined except the tautog contained vitamin A_1 alone, while those of all permanently freshwater fishes possessed only vitamin A_2. Those of all potentially migratory fishes, except perhaps the alewife, contained mixtures of both A_1 and A_2. Most livers contained mixtures of both vitamins A, and occasionally in proportion the reverse of those in the eye tissues.

Nutritional Cytopenia in the Monkey

W. C. Langston, W. J. Darby, C. F. Shukers and P. L. Day (*J. Exp. Med.*, **68**, 923; 1938) fed young rhesus monkeys (*Macaca mulatta*) on a diet containing casein, polished rice, whole wheat, salt mixture, sodium chloride, cod liver oil and ascorbic acid, with the result that they developed a syndrome characterized by anæmia, leukopenia and loss of weight. Ulceration of the gums and diarrhœa were common, and death took place between the twenty-sixth and hundredth day. Four animals were given the deficient diet with the addition of 1 mgm. of riboflavin daily and developed the characteristic signs and died in periods of time similar to the survival of the other monkeys. Nicotinic acid alone or combined with riboflavin and thiamin chloride also failed to alter the course of the deficiency. On the other hand, when the deficient diet was supplemented with either 10 gm. of dried brewers' yeast or 2 gm. of liver extract daily, normal development took place, and there was a normal blood picture for a long period. It is obvious, therefore, that yeast and liver

extract contain a substance, for which the authors propose the term 'vitamin M', which is essential to the nutrition of the monkey, and is not identical with any of the factors of the vitamin B complex which have been chemically identified.

Action of Eserine on Pancreatic Secretion

L. LIACI (*Biochim. e ter. experiment.*, **25**, 445; 1938) carried out experiments on dogs to determine the action of eserine on the external secretion of the pancreas. He found that small doses of this drug ranging from 0·10 mgm. to 0·18 mgm. per kilo injected intravenously had a stimulating action on this secretion as the result of two different mechanisms. The first acted through the vagus, while the second was connected with an increase of the stimulus produced by secretin, which in turn had been increased in quantity by the action of eserine. On the other hand, larger doses of eserine led to a diminution of the secretion and larger doses still might arrest the secretion altogether if it had started spontaneously. Liaci also found that pancreatic juice secreted after the administration of eserine was capable of digesting coagulated albumin without having received any previous activation.

Colonization of Krakatau by Mammals

IN 1883, the great eruption of Krakatau destroyed all vegetation and covered the island with a layer of hot ashes several metres deep. It may be assumed, therefore, that, whatever mammals existed previously, none survived the eruption. In an interesting account of the mammals now present on the island, Dr. K. W. Dammerman indicates the stages of the colonization (*Treubia*, **16**, 421; 1938). In 1908, Jacobson collected no mammals and saw none, probably none had yet arrived; but by 1919 bats, *Cynopterus brachyotis*, were present on two islands of the group; in 1920 a second species of the same genus was found on Krakatau itself, although on Verlaten Is. it did not appear for ten more years. It is noteworthy that these two species are fruit-eaters and that insectivorous bats were first collected in 1928 (*Hipposideros diadema*); in 1933 a fourth bat species made its appearance. The only other mammals which have so far gained a footing on the islands are rats. There was none in 1917, but by 1919 when a settler had been present for two years, the house-rat (*Rattus r. diardi*) had become a nuisance. By 1924, when the settler had gone and his house had already become a ruin, the rats had gone. This may have been due to the increase of the large python, but that is unlikely because by 1933 rats were again numerous. A second rat (*R. r. jalorensis*), the widespread Malay country-rat, had become established and was plentiful in 1928. The author notes that on his visits in 1933 and 1934 he saw a small and emaciated black dog, which must have escaped from some landing party and had been able to eke out a poor existence.

Migrations of the Gannet

THE origins of British gannets are few so that the movements of ringed birds are more easily related to breeding places. Of 6,384 gannets ringed, 203 have been recovered (3·2 per cent) and the recoveries, as analysed by Dr. A. Landsborough Thomson, show that birds in their first year are the most extensive rangers (*British Birds*, **32**, 282; 1939). Indeed more young birds are captured in African waters than in European. Older birds tend to confine their winter wanderings to the western shores of France and Spain, but it is clear that in general the approach of autumn brings with it a southward movement, which by the end of December has carried at any rate the birds of the year beyond the southern limits of Europe. A few scattered records show that occasionally gannets born on the west coast of Britain find their way in later years to the North Sea and even to the Baltic, and one Bass Rock individual was recovered from the Faeroes, near another breeding station. The oldest gannet recovered had reached an age of nine years, and it was then within a few miles of Ailsa Craig, where it had been ringed as a nestling.

Names of British Fishes

SCIENTIFIC names of even common British animals are still in the melting pot of priority; but a useful effort to establish the nomenclature of ten families of British fishes has been made by A. Fraser-Brunner (*Ann. Mag. Nat. Hist.*, Ser. 8, **2**, 410; Nov. 1938). The changes indicated mainly concern generic and subgeneric names, and for the larger families keys to the characters of these groups are given. Two new generic names are used: *Eutrigla* for *E. gurnardus*, which seems to be confined to European waters and is the only member of the genus; and *Diplecogaster* to include three of the gobies, the former *Cyclopterus bimaculatus*, selected as the type of the new genus, *Lepidogaster microcephalus* and *L. pellegrini*. The list includes two species which have recently been added to the British list—*Syngnathus rostelatus* from the Thames estuary and *Ammodytes marinus* recently described by Raitt.

Size of Nucleus in *Ricinus communis*

IN a communication to the Editors, Flora M. Scott, of the University of California at Los Angeles, comments on the very large size of the nuclei in *Ricinus communis*. Nuclei of the apical meristem, 3–4 microns in diameter, measure approximately 38 cubic microns in volume; nuclei of the differentiated pith and cortex, 332 cubic microns. This eight-fold increase has been shown by Monschau (*Protoplasma*, **9**, 536; 1930) to be a fairly general condition. In differentiating spiral elements, however, the diameters, or major axes of the larger nuclei range from 30 to 60 microns, so that resultant volumes may reach 50,000–60,000 cubic microns in round figures, an increase approximately 1,500-fold. When volume is plotted against frequency (some 1,800 nuclei were measured) a many-peaked graph is obtained. The earlier maxima occur at 332, 585, 755, 945, 1,146, 1,360 cubic microns, that is, at intervals of approximately 200 cubic microns. Thereafter the peaks occur with somewhat less regularity, and the curve flattens as it passes to 18,000, 22,000, 33,000, 55,000 and 60,000 in round figures. Since the diameters of the largest nuclei never exceed values approximately half the diameters of the containing vessels, nuclear diameter appears to be dependent on vessel diameter. Increase in volume is shown not to be attributable to chromatin. Dehydration of living nuclei by means of absolute alcohol indicates a relatively higher content of free (that is, removable) water in the largest nuclei, but the residual volumes after such dehydration show an actual volume increase over the meristem nucleus, 8 to 250-fold. This material is therefore mainly karyolymph. A detailed account will be published shortly.

A Dwarf Mutation in Coffee

IN an investigation of the genetics of the coffee plant, *Coffea arabica*, C. A. Krug, of the Instituto Agronomico of São Paulo, Brazil, has studied a dwarf type which appears in the variety *Murta* (*J. Genetics*, **37**, No. 1). Very little has yet been done with the genetics of coffee, and it takes three years for the plants to mature and produce seed. The variety *Murta* has small leaves, and when selfed yields *Bourbon*, *Murta* and dwarfs in the ratio 1 : 2 : 1. *Murta* plants are therefore heterozygous for the recessive dwarf gene. *Bourbon* is somewhat taller than *Murta*, with larger leaves, and does not carry dwarfness. The gene for dwarfness is somewhat unstable, frequently mutating to tallness, and the opposite mutation, tall to dwarf, also frequently takes place.

X-Ray Mutations in Rice

A DETAILED account of X-ray mutations in rice is given by Dr. N. Parthasarathy (*J. Genetics*, **37**, No. 1). The seeds of a pure line of rice were exposed to X-rays under different conditions for 1–3 hours and various types of mutations appeared. A semi-sterile mutant gave in the F_2 generation normal fertile plants, semi-steriles and dwarfs in the ratio 1 : 2 : 1. The semi-sterility was found to be due to the association of four chromosomes in meiosis. A chiasma was frequently present in the homologous regions proximal to the interchange in a pair of chromosomes, thus indicating crossing-over of the interchanged segments resulting in chromatid non-disjunction and abortion of 50 per cent of the pollen grains. One semi-sterile plant had two chromatin fragments, but their presence produced no visible phenotypic effect and they are rapidly eliminated in gamete formation. The dwarfs in the progeny of semi-steriles showed regular meiosis and fertile pollen with the ordinary chromosome number, but they did not set seed. Their origin is discussed and was probably due to a small deficiency or a gene mutation at or near the point of interchange. Two other mutants were trisomic. "Beaked sterile" is a primary $(2n + 1)$ type; while "stumpy" showed frequently a chain of five chromosomes, indicating that the extra was composed of segments derived from two non-homologous chromosomes of the haploid set.

Empirical Studies of the Seismic Phenomena of Hawaii

THIS is the title of a widely ranged study of the earthquakes of Hawaii by Austin E. Jones (*Bull. Seis. Soc. Amer.*, **28**, No. 4, 313; 1938). Small earthquakes in this region are frequent and from a study of the records it appears that the greater number of *P* waves have a period of 0·3 sec. whilst there is a subsidiary maximum of 0·5 sec. The *S* waves chiefly have a period of 0·5 sec., and there exists a subsidiary maximum of waves with a 0·8-sec. period. Large periods and amplitudes appear to go together, and the upper limits of the amplitudes were found to vary with the cube of the periods, though this probably holds only for local shocks. About 60 per cent of the foci are less than 5 km. deep and 70 per cent less than 10 km. deep. Most of the deep foci are under Mauna Loa and in the Kilauea south-east rift zone. A large number of the shallow foci are in and near the Kilauea crater. The location of epicentres near and on the extension of rifts and in pronounced lines and zones suggests a larger and more numerous system of rifts than has previously been mapped. The resulting pattern of rifts about Mauna Loa is roughly an asterisk, and the main group of epicentres is on the visible active rifts to the south-west and east-north-east of Mokuaweoweo.

Deep-Focus Earthquakes and Earth Structure near Japan

T. SHIDA discussed this subject at the opening of the Beppu Geophysical Laboratory on October 28, 1926; but it was not made generally available in Japan until 1937 (*Tikyû-Buturi* (*Geophys.*), 1, 1; 1937). The author's attention was directed to the peculiarities of the earthquake of January 21, 1906, it probably having a great depth of focus; but it was not until the similar earthquake of July 27, 1926, with epicentre near the Biwa Lake, that confirmation could be obtained. The depth of focus of this latter was about 260 km., or about twice the depth of isostatic compensation as generally accepted. The preliminary tremors indicated a shock of the fracture type, and this would seem to indicate appreciable strength to a depth of, say, 300 km., where the pressure may be expected to be of the order of 100,000 atmospheres. In Japan, the origins of some deep focus earthquakes seem to lie on a line running north-west–south-east through Honsyu. Shida is of the opinion that some slow process is always going on at a depth of about 300 km. in the neighbourhood of Japan, and that this is the true cause of seismic phenomena there, especially near the centre of the main island. The same author also thinks that there may be a jump in contraction of the earth's crust at a depth of about 300 km., and this may be the true cause of crustal changes and movements all over the world.

Research in Fuel Technology

AT the tenth autumn research meeting of the Institution of Gas Engineers, held in London on November 1–2, a number of papers on topical problems of the industry were received. One of them, however—the forty-third report of the Joint Research Committee of the Institution and the University of Leeds—was concerned with a possible future trend of fuel technology. This is the gasification of coal at high pressure. The report dealt with the condition under which gaseous hydrocarbons are synthesized from the elements at high pressure. It was shown that carbon, which combines only sluggishly with hydrogen at atmospheric pressure, can be caused to react freely at a red heat under pressure no higher than fifty atmospheres. Starting with coal or low-temperature coke, there is a rapid reaction with hydrogen as the temperature rises through a zone of temperature at which the structure of the coal or carbon is changing in the carbonization process. Above this temperature zone the reaction speed is greatly increased by the presence of alkali, and the results leave no doubt of the feasibility of gasifying British coal completely to yield gas of high calorific value suitable for public distribution. Moreover, the rate of gas production is much greater than currently experienced. Under some conditions, the thermal value of the gas produced per ton of coal per hour was more than fifty times greater than now obtained in gasworks practice. Naturally the supply of hydrogen is a vital factor in the economics of such a process, and this is envisaged as being obtained by the gasification of carbon with steam and oxygen under pressure. The results disclosed open the possibility of radical changes in the preparation of gaseous fuel. In such a process the gas would be generated under pressure, which would favour its wide distribution from central generating stations.

The Australian and New Zealand Association Jubilee Meeting

THE jubilee meeting of the Australian and New Zealand Association for the Advancement of Science, founded on the model of the British Association, has just ended after a most successful week of addresses and discussions at Canberra (January 11–18). It is the first time that the Association has met at the capital city of Canberra, and the meeting was probably unique by reason of the high ratio of visiting men of science to local members. Usually the meetings take place every two years at the big Australian and New Zealand cities in turn, where the visitors are lost in the large populations. Canberra is still a small garden city, and the problem of housing more than a thousand visitors was no small one.

The Australasian Association follows the British model very closely; but there are sixteen sections altogether. The president for the meeting was Prof. Ernest Scott, who delivered an address on the "History of Australian Science". The sectional presidential addresses included: Section A (Astronomy, Mathematics and Physics), "Physical Quantities", by Prof. T. Parnell; Section B (Chemistry), "The Atmosphere as a Raw Material", by W. Russell Grimwade; Section C (Geology), "Some Aspects of Glaciation in New Zealand", by Prof. R. Speight; Section D (Zoology), "The Role of Zoology in the Field of Modern Biology", by Prof. E. J. Goddard; Section E (History), "The Study of History: A Synoptic View", by Prof. R. M. Crawford; Section F (Anthropology), "Anthropology in Australia", by Prof. A. P. Elkin; Section G (Economics, Statistics and Social Science), "The Place of Expectations in Economic Theory", by L. G. Melville; Section H (Engineering and Architecture), "The Use and Convenience of Man", by Sir Henry Barraclough; Section I (Medical Science), "Physical Education in Relation to National Fitness", by Dr. E. Sydney Morris; Section J (Education, Psychology, and Philosophy), "Growing Up", by J. R. Darling; Section K (Agriculture and Forestry), "Some Aspects of Plant Pathology", by Dr. W. L. Waterhouse; Section L (Veterinary Science), "Some Modern Trends in the Study of Host-Parasite Relationships in Animal Disease", by Dr. L. B. Bull; Section M (Botany), "The Plant in Relation to Water", by Prof. J. G. Wood; Section N (Physiology), "The Protein Molecule", by Prof. W. J. Young; Section O (Pharmaceutical Science), "Some Aspects of Fifty Years Progress in Pharmaceutical Science", by Dr. E. M. Watson; Section P (Geography), "The Present Status of the Geographical Knowledge of New Guinea", by G. A. V. Stanley.

Among the more important discussions and symposia of the meeting was one on "Radio Research" (Sections A and H). A considerable liveliness in radio research is noticeable in Australia, one especially important field being the investigation of the ionosphere. Closely associated is the work of the Commonwealth Solar Observatory at Mount Stromlo, and considerable attention has been paid to the relationship between solar eruptions and radio fade-outs. Sections P and K enjoyed an excellent discussion on "Soil Erosion", a subject now of importance in Australia. This was introduced by a paper by Sir John Russell, a guest from England. The subject was tackled from practically every point of view: pastoral, soil chemistry, and geographical and forestry aspects also came into the picture.

Another well-developed discussion in which the Botanical, Physiological and Medical and Veterinary Sections were engaged, with representatives from the Chemistry Section, covered the subject of "Virus Diseases". Needless to say, no definite conclusions were reached as to the nature of viruses (living or non-living). They were accepted as particulate, and as consisting of nucleo-proteins. One view put forward claimed them as specialized derivatives (reduction forms) of bacteria. The chemists arranged symposia on "Colloids", and on "Organic Nitrogen Compounds".

A well-attended meeting of agriculturists held a symposium on the "Pasture Problems of Australia", and the Zoology Section, for the first time in Australia, had a day devoted to "Marine Biology and Fisheries", at which several interesting original papers were read. The Zoology Section also discussed the important problem of conservation of the native fauna of Australia, and resolutions were passed which are noted below.

The geologists held five symposia: "Metasomatism of Country Rock near Ore Bodies"; "Sub-divisions of the Lower Palæozoics in East Australia"; "The Permian Sequence in Australia"; and "Granitisation in Australia", being four of them.

It is impossible to indicate all the good work at the sections. The list of original papers shows a sustained rise in the results of research of a high standard, much of which has great economic value. Almost three hundred papers were listed for presentation at this meeting.

One of the most important meetings was a discussion covering all sections, the subject being "The Relation of Science to Society". It was opened by Sir David Rivett. This and many of the other discussions and presidential addresses were attended by the Governor-General, Lord Gowrie. The result of the discussion, at which references were made to the new activities of the British Association and of the American Association, was the formulation of several resolutions and the direction for the establishment of a committee to consider the whole subject. One recommendation was to the effect that: "In conjunction with the British and American Associations for the Advancement of Science, we wish to affirm our loyalty to the task of preserving truth, freedom of expression, and justice to the world. These are to-day subject to increasing attacks, which if successful will frustrate the future of Science and Humanity, which require that the labours of the Scientist must be utilised for the benefit and not the destruction of mankind."

Section A asked the Association to associate itself with a movement towards calendar reform.

The anthropologists asked the Association to urge the Australian Governments for funds to support the continuance of anthropological research now that the Rockefeller grants have been exhausted.

One of the most important recommendations adopted was a request from Section D, that all the Australian States should be warned of the importance

of establishing national reserves for the maintenance of the natural fauna and flora, and that these should be set up in more secluded areas and controlled and administered by experts. A request was also made for the beginning of a biological survey of Australia.

Excitement was lent to the proceedings of the Congress by two stimulating lectures given by Mr. H. G. Wells, who had been invited specially to Australia for the meeting. Mr. Wells was provocative, especially with his paper on "The Poison called History" which was delivered to the History Section; but attended by a great crowd, and much appreciated.

Other visitors specially invited from England were Sir John Flett, Sir John Russell, Prof. F. T. Brooks and Prof. N. V. Sidgwick. Prof. Brooks gave a lecture on "Epidemic Plant Diseases" and Prof. Sidgwick read a paper bearing the title "Multiple Links". Another visitor from England, Sir George Simpson, read a paper on "Electricity in Thunder Clouds" to Section A, and delivered a public lecture on "Ice Ages".

The Congress was an unqualified success, despite the terrific heat (109° in the shade one day), all records for Canberra being broken. W. J. DAKIN.

The Underground Water of London

AN excellent and serviceable memoir on "The Water Supply of the County of London from Underground Sources", prepared by Dr. Stevenson Buchan, has been issued by the Department of Scientific and Industrial Research (H.M. Stationery Office. 6*s*. 0*d*. net). It is primarily a supplementary development of the "Records of London Wells" by Messrs. Barrow and Wills, published by the Geological Survey in 1913, restricted in purview to the county boundaries and brought up to date by means of the later accumulation of information. Records of 1,080 wells are set out in detail, of which 565 make their appearance for the first time. More than one hundred of the records of strata are fully described, the remainder being in abstract form.

The memoir is commendably complete, for it gives a résumé of the history of London's water supply, with many interesting facts about the early and primitive sources from which it was drawn. So far back as 1236, water was brought to the City through conduits from wells and springs outside the populated area. Tyburn, Paddington, Hackney and Hampstead all contributed their quota during the period 1236–1549. In 1582, water was obtained from the Thames by a pump actuated by water wheels located at London Bridge. Then in 1613, the new river system was inaugurated, bringing supplies from springs in Hertfordshire, because at the beginning of the seventeenth century, the tributary streams through the town had become choked and partly buried, and few of the public wells remained. Towards the end of the eighteenth century, the first deep wells were sunk; but the movement did not make much headway for several years. Water companies were formed about the same period to draw supplies from the Thames and its tributaries, and to store it in reservoirs. These external surface sources now constitute the main feeder system.

As regards the wells, the early shallow borings were sunk to the sand and gravel terraces on the river banks. When, in course of time, these became polluted, deeper borings were made through the London Clay to the strata known as the Reading Beds and Thanet Sands, containing water either percolating from surface outcrops outside London or derived from the underlying chalk, which, acting as an enormous reservoir, to-day is the most important water-bearing bed under London. The water-level, however, is falling both in the sands (some supplies are actually exhausted in the northern area) and in the chalk, whence water is being extracted more rapidly than the rate of replenishment by the extremely slow flow which is alone possible under existing subterranean conditions.

As examples, the memoir mentions the wells close to the National Gallery, which, at one time, supplied the fountains in Trafalgar Square, many of the public buildings in Whitehall, the old Millbank Prison and the Houses of Parliament. Between 1844 and 1911, the water-level had fallen 127 ft., and the wells were shortly afterwards abandoned. Another well, which used to feed the Serpentine and its fountains, the Palace Lake and the lake in St. James's Park, had its water-level lowered by 96 ft. in the space of forty-eight years and was also abandoned.

With the increase in pumping and the growing competition for supplies, the lowering of the water-level is becoming more and more pronounced. New wells in the district of chalk outcrop are tapping quantities of water which might otherwise travel towards the centre of London. Moreover, land drainage over the surface of the outcrop is now more efficient and the quantity of rainfall available for absorption correspondingly diminished, both from this cause and also from the increase in impermeable surface due to building and road making. Finally, the prolonged periods of drought in recent years have exercised their adverse influence in preventing the recovery of lost levels. With the depression in level, there has been manifested an increase in salt water pollution of many wells down river from Bermondsey.

Wells have been sunk below the chalk to the Old Red Sandstone, the deepest of which is a well at Stonebridge Park, with a depth of 2,225 ft. Unfortunately, after encountering traces of oil and gas from levels below 1,500 ft., the final yield was small and distinctly saline.

The following conclusions are drawn as to the future of supplies from the chalk-sand reservoir under the County of London. The fall in water-level is likely to continue and the annual rate of depression to increase. If a uniform, or slightly increased rate of fall be assumed, the water will reach the base of the Upper Chalk in many parts of London during the present generation, and, at this level, it is probable that a negligible amount of water will be obtainable from the wells. There is, moreover, little likelihood of a supplementary supply from the beds below the Chalk under London.

BRYSSON CUNNINGHAM.

Academy of Sciences of the U.S.S.R.

THE election of members and member-correspondents of the Academy of Sciences of the U.S.S.R. took place in Moscow on January 28–29 at a general session of the Academy. Altogether fifty-six new academicians and a hundred and two member-correspondents were elected, the following being a list of those of scientific interest.

Department of Technical Sciences

Mechanics: Dr. N. I. Muskhelishvili, president of the Georgian Branch of the Academy of Sciences of the U.S.S.R., founder of a Soviet school in the theory of elasticity; Prof. N. E. Kochin (University of Moscow), a well-known authority on hydrodynamics; Prof. E. A. Chudakov (Bauman Mechanico-Machine Building Institute, Moscow), author of numerous works on automobile engineering.

Mining: Prof. L. D. Sheviakov; Prof. A. P. German, an expert on mining mechanics.

Technical Physics: Dr. N. D. Papalexi, an authority on theoretical and experimental radio-engineering; Dr. M. V. Shuleikin, an authority on radio-communications; Dr. V. P. Linnik, noted for his research in technical optics.

Energetics: Prof. M. V. Kirpichev (Molotov Institute of Energetics in Moscow), an authority on heat engineering; V. P. Nikitin, director of the Bauman Mechanico-Machine Building Institute of Moscow), an authority on electrical welding; Prof. V. S. Kulebakin (Zhukovsky Military Aviation Academy), known for his work on electro-technics.

Metallurgy: Dr. N. P. Chizhevsky, noted for his researches in the technology of metallurgical fuel; Prof. N. T. Gudtsov (Leningrad Industrial Institute), noted for his work on special steels.

Transport (hitherto not represented in the Department): Dr. V. N. Obraztsov, an authority on the planning of railway stations and junctions; Dr. V. L. Posdiunin, known for his work on theoretical and practical questions relating to shipbuilding.

The following member-correspondents were also elected: G. V. Akimov, P. F. Antipin, I. I. Artobolevsky, I. M. Bakhurin, N. M. Beliayev, A. A. Bochvar, I. S. Bruk, N. G. Bruyevich, A. B. Chernyshev, D. M. Chizhikov, S. A. Christianovich, Z. F. Chukhanov, N. M. Gersevanov, A. V. Gorinov, A. S. Ilyichev, M. A. Kapcliushnikov, M. M. Karnaukhov, V. I. Kovalenkov, M. P. Kostenko, A. B. Lebedev, G. P. Peredery, A. S. Predvoditelev, L. N. Sretensky, S. S. Steinberg, M. A. Velikanov, V. P. Vologdin, I. N. Voznesensky, B. M. Vul and V. V. Zvonkov.

Department of Mathematical and Natural Sciences

Physico-Mathematical Sciences: Dr. S. L. Sobolev; Dr. A. N. Kolmogorov; Prof. V. A. Fok (University of Leningrad); Dr. P. L. Kapitza, director of the Institute of Physical Problems of the Academy of Sciences; G. A. Shain, astronomer at the Simeiz Observatory.

Chemistry: Prof. S. S. Nametkin (University of Moscow), author of a number of works on oils and synthetic aromatic substances; Dr. A. P. Orekhov, noted for his research in alkaloids; Prof. P. P. Shorigin (Stalin Industrial Academy), noted for his work on the creation of artificial fibres; Dr. V. G. Khlopin, director of the Radium Institute of the Academy of Sciences; Dr. A. N. Terenin, noted for his research in the complex processes of photographic chemistry.

Geology and Geography: Dr. M. A. Usov, authority on the mineralogy of Western Siberia; Dr. P. I. Stepanov, authority on coal deposits of the U.S.S.R., particularly of the deposits in the Donets Basin; Dr. A. N. Zavaritsky, noted for his work on the ore deposits of the Urals; Dr. P. P. Shirshov, who took part in the North Polar Expedition on the drifting ice-floe of 1937–38; Dr. A. A. Grigorev, known for his work in physical geography.

Biology: Dr. T. D. Lysenko, noted for his work on vernalization; Dr. N. V. Tsitsin, known for his work in obtaining a hardy perennial wheat by crossing winter wheat with couch grass; Dr. L. S. Stern (the only woman academician elected), and Dr. I. S. Beritashvili, both noted for their original work in physiology; Dr. E. N. Pavlovsky, director of the Tajikistan base of the Academy of Sciences, noted for his research in applied zoology; Dr. K. I. Skriabin, an outstanding authority on veterinary science.

Medicine (this is the first time that representatives of medicine have been elected to the Academy): Drs. N. N. Burdenko, A. I. Abrikosov, M. I. Auerbach, N. N. Anichkov and A. D. Speransky.

Dr. Y. M. Shokalsky, known for his work in geography, was elected an honorary member of the Academy.

The following member-correspondents were also elected:

Physico-Mathematical Sciences: A. I. Alikhanov, V. A. Ambartsumian, S. I. Beliavsky, A. O. Gelfond, A. Y. Khinchin, A. A. Lebedev, M. A. Leontovich, L. S. Pontriagin, I. I. Privalov, D. V. Skobelstin.

Chemical Sciences: P. P. Budnikov, N. A. Izgarishev, A. F. Kapustinsky, I. A. Kazarnovsky, A. N. Nesmeyanov; N. I. Nikitin, V. M. Rodionov, S. Z. Roginsky, G. G. Urazov, S. I. Volfkovich.

Geologo-Geographical Sciences: N. N. Baransky, E. K. Fedorov, S. F. Fedorov, I. F. Grigoriev, F. N. Krasovsky, P. I. Lebedev, F. P. Savarensky, S. S. Smirnov, A. N. Tikhonov, A. G. Vologdin.

Biology: E. A. Asratian, V. P. Bushinsky, V. A. Dogel, A. A. Grossheim, K. S. Koshtoyants, A. I. Oparin.

Medicine: N. F. Gamaleya, N. I. Grashenkov, P. A. Herzen, M. B. Krol, B. I. Lavrentiev, V. P. Osipov, N. N. Petrov, O. N. Podvysotskaya.

Early in February, reorganization of the Academy of Sciences was discussed in connexion with the election of the large number of new academicians and member-correspondents enumerated above, as well as the substantial changes that have taken place in the structure of the Academy itself. As against the previous three departments—Department of Technical Sciences, Department of Mathematical and Natural Sciences, Department of Social Sciences—eight departments are being formed, namely: Department of Physico-Mathematical Sciences, Department of Chemistry, Department of Geology and Geography, Department of Biology, Department of Technical Sciences, Department of History and Philosophy, Department of Economics and Law, Department of Languages and Literature.

Paris Academy of Sciences

Annual Prize Awards

AT the annual public meeting of the Paris Academy of Sciences held on December 19, M. Aimé Cotton, president, announced the following prize awards:

Mathematics. Poncelet Prize to Prof. S. Mandelbrojt, for the whole of his work on analytical functions. Francœur Prize to Prof. J. Dieudonné, for his work on the theory of functions.

Mechanics. Montyon Prize to Prof. L. Couffignal, for his work on mechanisms. Fourneyron Prize to V. Hégly, for researches in hydraulics. Henri de Parville Prize to Mme. M.-L. Dubreil-Jacotin, for her work on periodic waves. Henry Bazin Foundation (5,000 francs) to M. Mennesson, for his work on the utilization of pneumatic currents for the measurement of lengths and thicknesses.

Astronomy. Lalande Prize to A. Lallemand, for his work on physical astronomy. Damoiseau Prize to H. Fabre, for his work on recurrent movements in celestial mechanics. Benjamin Valz Prize to P. Lacroute, for his work on physical astronomy. Janssen Medal to B. Lindblad, of Stockholm, for his work in theoretical and physical astronomy. La Caille Prize to P. Baize, for his work on visual double stars. Antoinette Janssen Foundation (5,000 francs annually for 1938–42) to V. Kourganoff, for his work on theoretical astronomy.

Geography. Delalande-Guerineau Prize to J. Soubrier, for the whole of his travels in the Sahara, French West Africa and Liberia, northern Albania, Kurdistan and Iraq. Gay Prize to A. Romer, for the organization and starting of the Geophysical Observatory of Martinique and for his observations on Mont Pelée. Tchihatchef Foundation to P. Carton, for his work on the meteorology of Indo-China. Binoux Prize to Capt. A. Nandillon, for the whole of his work on applications of acoustics to navigation.

Navigation. Plumey Prize to M. Serruys, for his work on internal combustion motors.

Physics. L. La Caze Prize to Prof. H. Ollivier, for his work on the relations of magnetism and magnetic rotatory polarization. François Hébert Prize to M. Haïssinsky, for his work on atomicity and chemistry. Hughes Prize to P. Girard, for his work on the measurement of dielectric constants. Danton Foundation to P. Lambert, for his researches on radiation. Clément-Félix Foundation to R. Freymann, for his work on infra-red radiation. Général Ferrié Foundation to F. Bedeau, for his work on high-frequency waves.

Chemistry. Montyon Prize (Unhealthy Trades), a prize (2,500 francs) to the late R. Schmutz, for his work on hygiene and passive defence, in particular that which concerns the detection of gases; an honourable mention (1,500 francs) to G. Courtois, who has taken an active part in perfecting apparatus for protection against noxious gases. Jecker Prize to Prof. A. Wahl, for his work on colouring matters and, in particular, on the indigoids. L. La Caze Prize to Prof. P. Jolibois, for inorganic chemistry. Cahours Foundation to R. Guillemet, for his work on [biological] chemical analysis. Houzeau Prize to M. Badoche, for his work on bodies of the rubrene family and for his measurements of heats of combustion of numerous nitrated derivatives. Ch. Adam Girard Foundation to Prof. R. Quelet, for his work in organic chemistry.

Mineralogy and Geology. Fontannes Prize to L. and J. Morellet, for their palæontological studies of the tertiary areas of the Paris region. André-C. Bonnet Prize (palæontology) to J. Piveteau, for the whole of his palæontological work and notably for his memoir "Paléontologie de Madagascar, XXII. Un Amphibien du Trias inférieur. Essai sur l'origine et l'évolution des Amphibiens Anoures". James Hall Prize to J. Goguel, for a thesis entitled "Description tectonique de la bordure des Alpes, de la Bléone au Var".

Geophysics. Victor Raulin Prize to G. Grenet and J. Coulomb, for their work on electrically registering seismographs.

Botany. Desmazières Prize to J. Feldmann, for his researches in algology. Montagne Prize to R. Heim, for his researches on the Agaricinæ. De Coincy Prize to Mlle. M.-T. Gertrude, for her work on the morphogenesis of *Veronica Anagallis*.

Rural Economy. Paul Marguerite de la Charlone Prize to Prof. V. Ducomet and E. Foëx, for their researches on plant pathology and genetics during the past twenty years on the potato.

Anatomy and Zoology. Cuvier Prize to G. Seurat, for the whole of his zoological work. Savigny Foundation to C. Crossland, director of the Zoological Station of the Egyptian University at Ghardaqa, for his researches on the fauna of the Red Sea. Jean Thore Prize to T. Monod, for his work on Crustacea.

Anthropology. André-C. Bonnet Prize to Prof. E. Dubois (Amsterdam), for his discovery of *Pithecanthropus* in Java and his researches on the phylogenetic development of the brain.

Medicine and Surgery. Montyon Prizes (2,500 francs) to Prof. L. Binet and G. Weller, for their book "Le Glutathion"; Prof. A. Pettit, for his book "Sérothérapie antipoliomyélitique d'origine animale"; F. Trensz, for the whole of his work on paludal serology. Honourable Mentions (1,500 francs) to Prof. M. Barthélemy, for his book "Les diagnostics chirurgicaux au lit du malade"; A. Bensaude, for his book "L'évolution cancéreuse des tumeurs bénignes du rectum. Son importance pour la prophylaxie du cancer du rectum"; Mlle. M. Ladet, for her book "Le syndrome malin au cours des toxi-infections". Barbier Prize to Prof. L. Courty and M. Ansel, for their work "Le traitement chirurgical du goître exophtalmique et des goîtres avec hyperthyroïdie". Bréant Prize to P. Remlinger and J.-E. Bailly, for their work "Contribution à l'étude du virus de la maladie d'Aujeszky". Godard Prize, no award. Mège Prize (1,000 francs) to A. Donatien and F. Lestoquard, for their work concerning animal rickets. Bellion Prize to Prof. P. Coulouma, for his work "La terminaison des nerfs pneumogastriques et ses variations. Étude d'anatomie descriptive comparée chez l'homme et dans la série des Vertébrés", and the whole of his anatomical work. Baron Larrey Prize to Colonel M. Liégeois, for his memoir relating to the general etiology of scarlatina, its modes of propagation, its prophylaxy and its therapy. Jean Dagnan-Bouveret Prize (6,000 francs) to Mme. A. Randoin (née L. Fandard), for the whole of her researches on the physiology of nutrition;

5,000 francs to X. Henry, for his method of diagnosing paludism called melano-flocculation; 4,000 francs to L. Delhoume, for his work "L'École de Dupuytren : Jean Cruveilhier et Claude Bernard : pensées".

Cancer and Tuberculosis. Roy-Vaucouloux Prize to V. Vilter, for his researches on the physiological mechanism of the variations of colour of amphibians and fish. Louise Darracq Prize, awarded for work in the fight against cancer, to A. Peyron and his collaborators of the Institut Pasteur, for the whole of their work. Eugène et Amélie Dupuis Prize, not awarded.

Physiology. Montyon Prize to M. Fontaine, for the whole of his work. L. La Caze Prize to Prof. A. Mayer, for the whole of his work. Pourat Prize to M. Florkin, for his work "Physiologie comparée du milieu intérieur dans la série animale". Martin-Damourette Prize to R. Duffau, for his work "Avitaminoses et Métabolisme glucidique musculaire".

Statistics. Montyon Prize (1,000 francs) to H. Bunle, for the whole of his statistical work; and 1,000 francs to Prof. G. Ichok, for his work "La mortalité à Paris et dans le département de la Seine".

History and Philosophy of the Sciences. Binoux Prize: 2,000 francs to Prof. A. Sesmat, for his works "Le système absolu classique et les mouvements réels" and "Les systèmes privilégiés de la physique relativiste"; 1,500 francs to J. Torlais, for his work "Réamur".

Works of Science. Henri de Parville Prize: 2,500 francs to A. Danjon and A. Couder, for their work "Lunettes et télescopes. Théorie. Conditions d'emploi. Description. Réglage"; 2,000 francs to M. Duportet, towards his work on the topobibliography of France, of which three volumes have appeared.

Medals. Berthelot Medals to the late R. Schmutz, M. Badoche, and R. Quelet.

General Prizes. State Prize (Grand Prize of the Mathematical Sciences) to Prof. J. Favard, for his work in algebra and geometry. Bordin Prize to H. Schœller, for his geological work in the Alps and his hydrogeological researches in Tunisia. Lallemand Prize to A. Fessard, for his researches on the rhythmic functions of the nerves. Serres Prize to Prof. R. Courrier, for his work on the genital function in mammals. Vaillant Prize to Prof. L. Bounoure, for his researches on the embryogeny of amphibians. Estrade-Delcros Prize to Prof. J. Jolly, for the whole of his histophysiological work. Houllevigue Prize to B. Lyot, for his work on the solar corona. Saintour Prize to A. de Cugnac, for his work on the Gramineæ. Jules Mahyer Prize to R. Echevin, for his work on plant physiology. Lonchampt Prize to J. Lavollay, for his work on the biochemistry of magnesium. Henry Wilde Prize to H. Hulubei, for his discovery of element 87, belonging to the series of alkali metals. Caméré Prize to Prof. L. Grelot, for his contribution to the progress attained in the construction of metal and reinforced concrete bridges. Gustave Roux Prize to Prof. H. Vigreux, for his work "Le soufflage du verre dans les laboratoires scientifiques et industriels". Thorlet Prize, not awarded. Albert Ier de Monaco Prize to Prof. A. Denjoy, for the whole of his mathematical work. Marquet Prize to Prof. R. Bricard, for his work in geometry. Général Muteau Prize to Prof. H. Abraham, for his work in electricity, principally for apparatus he has devised, some of which has been used in national defence, and for progress made in high precision measurements.

Prix des Grandes Écoles. Laplace Prize to R. Loison. L.-E. Rivot Prize between R. Loison (750 francs), L. Boucheny (500 francs), A. Pages (750 francs) and P. Clos (500 francs).

General Funds for Scientific Researches

Trémont Foundation to Mme. L. Nouvel, for her work "Contribution à l'étude de la mue, de la croissance et de la régénération chez les Crustacés Natantia".

Gegner Foundation to M. Aubert, for his researches on internal combustion motors.

Jérôme Ponti Foundation to Prof. J. Pérès, for his work on the mechanics of fluids.

Hirn Foundation to Prof. H. Chrétien, for his researches on optical instruments.

Henri Becquerel Foundation to Prof. P. Delens, for his work on analysis and geometry.

Loutreuil Foundation (total grants, 117,500 francs). Researches on set problems. 3,000 francs to Mlle. F. Bloch, for work on cutaneous tuberculosis; 2,000 francs to A. Brizard and R. Florio, for researches on dermatoses of the horse and of the dog; 7,500 francs to D. Chalonge, D. Barbier and A. Arnulf, for work at the international scientific station at the Jungfraujoch; 6,000 francs to Prof. L. Daniel, for work on the pedigree culture of the Jerusalem artichoke; 3,000 francs to Prof. R. Dubrisay, for studies of the action of sulphur on different metals, and notably silver; 5,000 francs to A. F. de Lapparent, for work on the Dinosaurs of the south of France; 2,000 francs to Prof. A. Métral, for work on the improvement of output of heat engines by the transformation into reactive energy of the potential and kinetic energy of the exhaust gases; 5,000 francs to Prof. M. Pierre, for researches on the regulatory mechanism of calcæmia and of phosphatæmia in the domestic animals.

Researches to be carried out in France Overseas. 8,000 francs to A. Lasserre, for work on terrestrial magnetism in Algeria and the Algerian Far South.

Purchase of laboratory material. 4,000 francs to Prof. F. Diénert, for apparatus for utilizing geophysical methods for the study of subterranean currents; 5,000 francs to Prof. P. Fleury, for a Moll double thermo-converter, for the study of the photometry of incandescent lamps fed with alternating current; 3,000 francs to Prof. P. Frémy, for a photomicrographic apparatus; 3,000 francs to Prof. P. Lamare, for a precision balance; 2,000 francs to Prof. J. Lefèvre, for microphotography material; 10,000 francs to Prof. E. Marchoux, as a contribution towards a Feussner spectrograph installed at the Pasteur Institute; 9,000 francs to P. Teilhard de Chardin, as a contribution towards the equipment of his laboratory for advanced studies in human palæontology.

Libraries. 7,000 francs to the National Veterinary School of Alfort, for the purchase of periodicals; 7,000 francs to the National Veterinary School of Lyons, for the purchase of books and foreign periodicals; 2,000 francs to the National Veterinary School of Toulouse, for the purchase of books and scientific publications; 2,000 francs to the National Agronomic Institute, for the acquisition of foreign periodicals.

Publications. 8,000 francs to the Comité de physique du globe des colonies, as a contribution to the publication of the *Annales de physique du Globe de la France d'Outre-Mer*; 3,000 francs to P. Chabanaud, for the publication and illustration of works on the morphology of non-symmetric teleosteans; 3,000 francs to G. Guilbert, for printing a work entitled "L'Orage, sa genèse, ses mystères, sa prévision"; 8,000 francs to Prof. P. Lemoine, to assist in the publication of a geological study of Mauritius.

Mme. Victor Noury Foundation (four prizes of 2,500 francs each): A. Lenoble, for his researches on

the chronological succession of the volcanic eruptions of central Madagascar, the age of the *coulées* of the east side and his discovery of organic remains in the Cristallophyllian of the island; Prof. A. Luquet, for his biogeographical work and particularly for that concerning the Central Massif; E. Thellier, for his work on the magnetization of clays and of burnt earths, with application to the study of the evolution of the terrestrial magnetic field; P. Vintemberger, for his researches in experimental embryology.

Millet-Ronssin Foundation: 4,000 francs to A. Balachowsky, for his work on agricultural entomology, and in particular for his book "Les Insectes nuisibles aux Plantes cultivées", published in collaboration with L. Mesnil; 3,000 francs to Prof. A. Carpentier, for his palæobotanical work, and particularly for that concerning the oil earths of the north of France and of the Central Massif, the Permian, the Jurassic and the Cretaceous of France, Morocco and Madagascar; 3,000 francs to Prof. H. Chermezon, for his work on the Cyperaceæ and the flora of Madagascar.

Villemot Foundation: 12,000 francs to L. Blaringhem, for the installation at the Gaston Allard Arboretum, at Angers, of an exact electrically heated bed; 14,000 francs to Mlle. G. Cousin, for the purchases of stoves; 10,000 francs to G. Deflandre, for the purchase of microscope objectives; 12,500 francs to Prof. L. Dunoyer, for the purchase of a Ribaud optical micropyrometer; 5,500 francs to E. Esclangon, for the construction of a double clock with two dials, indicating simultaneously, with very high precision, mean solar time and mean sidereal time; 15,000 francs to Prof. H. Guillon, for perfecting an apparatus for the measurement of high temperatures of gases by the method of aspiration pyrometry; 10,000 francs to C. Harnist, for his projected researches on the manufacture of sulphuric acid from gypsum; 10,000 francs to the Institut Marey, for researches on the ultra-rapid cinematography and oscillographic recording of the nerve influx; 25,000 francs to P. Lejay, director of the Observatory of Zi-Ka-Wei, for his researches on the application of the inverted electrical pendulum to the precise determination of the inclination of the axes of astronomical instruments; 10,000 francs to Prof. M. Macheboeuf, for his researches on the chemical phenomena of immunity; 15,000 francs to R. Martin, for perfecting thermochemical material intended for the determination of the quantity of energy resulting from the chief combustions and reactions utilized in industry; 8,000 francs to A. Peyron, for his experimental and comparative studies of the pathology of tumours; 20,000 francs to A. Savornin, for the purchase of an inclination needle for absolute magnetic measurements; 12,000 francs to H. Vincent, for the purchase of reactive experimental animals for his researches on the pathogeny of certain infectious maladies and the conditions of immunity; 10,000 francs to R. Wurmser, for the purchase of experimental animals.

Charles Frémont Foundation to C. Berthelot, for his works "Technique et Économie nouvelles des carburants de synthèse" and "Épuration, séchage, agglomération et broyage du charbon".

Special Foundations

Lannelongue Foundation to Mme. G. Cusco; Girbal-Baral Foundation (10,000 francs each) to F. Marty and F. Roger; D'Aumale Prizes (5,000 francs each) to the widow of C. Gravier and the daughter of the late C. Flahault.

Science News a Century Ago

Samuel Cunard and Robert Napier

The long connexion of Robert Napier with the Cunard Steamship Company, for which he built eighteen trans-Atlantic steamships, began with two letters, one written by Samuel Cunard on February 25, 1839, and the other, Napier's reply written three days later. Writing from Piccadilly to his Glasgow agents Cunard said, "I shall require one or two steamboats of 300 horse power and about 800 tons. I am told that Messrs. Wood and Napier are highly respectable builders and likely to be enabled to fulfil any engagement that may enter into." In his reply to Cunard's agents, Napier said, referring to the price, "I have done them as low as £35 per ton of total measurement of the vessel, and I have got above £50 per ton for some others. I may, however, state that good vessels, *warranted* to stand any inspection and give entire satisfaction both as to the vessel and machinery, cannot be done for less than from £40 to £42 per ton—this for the vessel ready for sea, with cabins, sails, rigging, anchors, cables, etc. . . ."

After further negotiations a contract was arranged for the construction of the four vessels, *Acadia*, *Britannia*, *Caledonia* and *Columbia*. The *Britannia*, 1,150 tons, 420 horse-power, was the first finished, and she sailed on her maiden voyage from Liverpool to Boston, July 4, 1840.

University College, London

The annual meeting of the proprietors of University College was held on February 27, 1839. The chief topic handled in the report of the Council, said the *Athenæum* of March 2, was the regulations of the University dealing with the degree in arts. From the report it added, "we learn that the Exhibitions offered by the Government as a reward for proficiency in passing the matriculation examination have been divided between students of University College and King's College." Among the novelties announced were the class for schoolmasters, the class for civil engineers and the school for practical chemistry; the erection of a spacious building for the practice of anatomy, and the fitting up of a large room as a library for medical students. In 1837–38 there were 497 students in medicine, 142 in arts and 337 boys in the Junior School.

Prof. W. T. Brande as a Lecturer

On March 1, 1839, Faraday's colleague at the Royal Institution, Prof. William Thomas Brande (1788–1866), gave a lecture on steel, a report of which appeared in the *Mechanics' Magazine* of March 16, 1839. The report concluded with saying, "No one will question the great ability of Mr. Brande as a lecturer, but we could almost indulge the wicked wish of being able to tamper with, and manœuvre a little, the progress of the clock in order to see the good effect for once of surprising him out of the extreme deliberateness of his delivery. . . . Unfortunately, also he does not think it necessary to raise his voice higher than in common conversation, but though his enunciation is so beautifully distinct, that with *listening* attention, he may be heard in most parts of the theatre, yet the continued effect to give such attention, especially at this time of the year, when everybody thinks it his duty to cough, soon becomes very fatiguing, and at last so painful as quite to mar the pleasure of hearing him lecture."

Societies and Academies

Edinburgh

Royal Society of Edinburgh, February 6.

P. A. M. DIRAC: The relation between mathematics and physics (Address). In setting up a theory of natural phenomena, one strives in the first place for simplicity; but it seems that mathematical beauty is really a more important quality than simplicity. It is difficult to put any limitation on the extent to which mathematics applies to the description of the universe, and one is led to think that it must apply to everything. In such a complete scheme one could scarcely expect simplicity, but one may well have beauty. The discussion of these questions is much influenced by modern advances in quantum mechanics and in cosmological theory.

R. A. ROBB and T. R. TANNAHILL: Lunar atmospheric pressure variations at Glasgow. The Glasgow barograph records of 1868–1912 have been examined for the determination of the lunar atmospheric tide at Glasgow. It is found that on barometrically quiet days there exists a local lunar variation, mainly diurnal in character, not predicted by theory. The diurnal component appears to increase progressively with quietness of day. Removal of this variation results in a probable value of the normal lunar tide of:

$$0{\cdot}0110 \sin (2\theta + 60^\circ) \text{ millibar},$$

θ being reckoned from upper lunar transit.

Paris

Academy of Sciences (*C.R.*, **208**, 237–312, Jan. 23, 1939).*

L. DOMANGE: Stability of manganic sulphate in aqueous solutions of sulphuric acid.

MILLES. M. MONTAGNE and Y. ISAMBERT: Action of ethylmagnesium bromide on butyric ethylanilide.

P. GRAMMATICAKIS: Secondary reactions observed in the course of the condensation of organo-magnesium compounds with phenylhydrazones.

L. PALFRAY, S. SABETAY and A. HALASZ: Preparation of some alcoxy- and arylalcoxyethanols and higher homologues.

E. A. DE LA RÜE: Contribution to the mineralogical study of the coast of French Somaliland.

A. MICHEL-LÉVY and J. WYART: Synthesis of orthose and of albite by pneumatolysis with the aid of explosives.

E. DESGUIN and A. DAUVILLIER: Origin of life.

P. DANGEARD: The alga *Vaucheria* observed in the region of the south-west [of France], and a new species of this genus.

G. LAISNE: Variations of the osmotic pressure of tissue sugar of *Fraxinus excelsior* L. and of some other plants in the course of artificial haymaking.

J. LEFÈVRE: Similarity of the cytological effects exerted by phenylurethane and colchicine on plants.

J. COMANDON and P. DE FONBRUNE: Preparation and mode of action of traps of predatory fungi for nematodes; investigations by the aid of micro-manipulation and cinematography.

R. GIRARD: A case of evolution of *Hypoderma bovis* De Geer on the horse.

M. PIETTRE: Conditions of preparation, at low temperatures, of crystalline oxyhæmoglobin.

G. MOURIQUAND: Resistance to avitaminosis.

(*Continued from p. 307)

Cracow

Polish Academy of Sciences and Letters (*C.R., Classe Sci. Math. et Nat.*, Jan. 9, 1938).

W. FRIEDBERG: Attempt at a stratigraphy of the Miocene of Poland, based on the molluscan fauna (2).

F. ROGOZIŃSKI: (1) Chlorophyll and the carotinoids of some marine algæ (from the Gulf of Naples). Carotinoids are present in relatively large quantities in brown and green algæ, but in small quantities in red algæ. Chlorophyll is low in brown and red algæ, while in certain green algæ the quantity is greater than in many land plants. (2) Chlorophyll in the digestion of larvæ of certain Lepidoptera. Gravimetric estimation of the chlorophyll in the excrement of certain Lepidoptera shows that it is present in considerable quantity and unaltered in form.

W. ŚWIENTY: Blood vessels in the ventral fins of certain teleosteans.

A. KOZŁOWSKI: Researches on the summer eggs of aphids. Synchronous and heterochronous segmentation are found in these parthenogenetic eggs up to the sixth division. During the seventh division and later, synchronous division of all the cells was never observed.

Dublin

Royal Irish Academy

R. LLOYD PRAEGER: A further contribution to the flora of Ireland. This is an epitome of recent advances in our knowledge of the flora of Ireland, so far as the higher plants are concerned, and forms a supplement to the census of the Irish flora which was given in "The Botanist in Ireland" published in 1934.

Tokyo

Imperial Academy (*Proc.*, **14**, No. 10, 359–397; 1938).

KÔSAKU YOSIDA, YUKIO MIMURA and SHIZUO KAKUTANI: Integral operator with bounded kernel.

KÔSAKU YOSIDA: Operator-theoretical treatment of Markoff's process.

MASAO INOUE: Process of constructing the solution to Dirichlet's problem.

KEISIN SUZUKI, MASAAKI HURUHATA and GORÔ KUROIWA: Photographic observations of new variables and some known variables in Cygni. With the 10-cm. triplet camera attached to the 20-cm. refractor at the Tokyo Science Museum, 125 photographs were taken around α and η Cygni.

KOJI HIDAKA: (1) Horizontal oscillations of bay water induced by tidal currents. (2) Free oscillation of water in an oval basin.

SHÔSHIRÔ HANZAWA: Studies on the foraminiferal fauna found in the bore cores from the deep well in Kita-Daitô-Zima (North Borodino Island). The following characteristics were examined: (*a*) lithological character of the bore cores; (*b*) organic contents and the state of preservation of fossils; (*c*) distribution of the foraminiferal fauna in the bore core and their stratigraphical ranges; geological ages of the bore cores.

TORANOSUKE SUGIURA: A list of chromosome numbers in angiospermous plants. (5). Species from eighteen families are given.

TOKI-O YAMAMOTA: Distribution of temperature constants in *Oryzias latipes*.

SEIGO FUNAOKA AND NORITOKI SAITO: Study of lymph.

Forthcoming Events

[*Meetings marked with an asterisk are open to the public.*]

Monday, February 27

UNIVERSITY COLLEGE, LONDON, at 5.—Dr. L. Young: "Animal Detoxication Mechanism" (succeeding lectures on March 6 and 13).*

Tuesday, February 28

UNIVERSITY COLLEGE, LONDON, at 5.15.—Dr. W. E. Swinton: "The Use of Museums. (4) Natural History in Museums".*

CHADWICK PUBLIC LECTURE (at the Royal Society of Tropical Medicine and Hygiene), at 5.30.—Prof. Major Greenwood, F.R.S.: "Occupational and Economic Factors of Mortality".*

GRESHAM COLLEGE, at 6.—A. R. Hinks, F.R.S.: "Different Kinds of Nebulæ" (Gresham Lectures on Astronomy. Succeeding lectures on March 1, 2 and 3)*.

ROYAL PHOTOGRAPHIC SOCIETY (SCIENTIFIC AND TECHNICAL GROUP), at 7.—Annual General Meeting.

Wednesday, March 1

INSTITUTION OF ELECTRICAL ENGINEERS (Wireless Section). Symposium of papers on "Direction Finders" presented by Dr. R. L. Smith-Rose.

Thursday, March 2

CHEMICAL SOCIETY (at the Imperial College of Science and Technology), at 5.30.—Symposium on "Micro-technique in Organic Chemistry" to be opened by Prof. I. M. Heilbron, F.R.S.

Friday, March 3

SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS (at the Institute of Chemistry, 30 Russell Square, W.C.1), at 5.—Annual General Meeting.
Sir Henry Dale, F.R.S.: "Biological Standardiantion".

UNIVERSITY COLLEGE, LONDON, at 5.15.—K. de B. Codrington: "The Use of Museums. (5) Museums, Past and Future".*

GEOLOGISTS' ASSOCIATION (at University College, London), at 7.30.—Annual General Meeting.
Prof. H. L. Hawkins, F.R.S.: "A Short History of Sea-Urchins".

ROYAL INSTITUTION, at 9.—Sir William Bragg, O.M., F.R.S.: "Liquid Films".

Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

CHEMIST at the Royal Gunpowder Factory, Waltham Abbey—The Principal Clerk, Royal Gunpowder and Small Arms Factories, Enfield Lock, Middlesex (March 3).

TEACHER OF TELECOMMUNICATIONS AND PHYSICS in Woolwich Polytechnic, London, S.E.18—The Secretary (March 3).

HEAD OF THE DEPARTMENT OF CHEMISTRY in Bradford Technical College—The Director of Education, Town Hall, Bradford (March 4).

ASSISTANT NATURALIST in the Millport Marine Laboratory—The Secretary, Scottish Marine Biological Association, 185 St. Vincent Street, Glasgow, C.2 (March 6).

JUNIOR SCIENTIFIC OFFICER in the External Ballistics Department of the Ordnance Board, Royal Arsenal, Woolwich, London, S.E.18—The Secretary (March 8).

SCIENTIFIC OFFICER (physics or engineering) in the Air Ministry Scientific Research Pool—The Under-Secretary of State, Air Ministry (S.2.D.), Berkeley Square House, London, W.1 (March 11).

PROFESSOR OF MATHEMATICS in the University of Durham (Durham Division)—The Registrar (March 16).

EXAMINERS in various science subjects for the Matriculation and General School Examination of the University of London—The Secretary to the Matriculation and School Examinations Council, University of London, W.C.1 (March 17).

ASSISTANT CIVIL ENGINEERS in the Civil Engineer-in-Chief's Department of the Admiralty—The Civil Engineer-in-Chief, Admiralty, S.W.1.

ASSISTANT INSTRUCTOR IN ENGINEERING in a new trade school in Hong Kong—The Crown Agents for the Colonies, 4 Millbank, London, S.W.1 (*M*/8306).

RESEARCH OFFICER to the Tyneside Council of Social Service—The Director, 17 Ellison Place, Newcastle-upon-Tyne.

Reports and other Publications

(not included in the monthly Books Supplement)

Great Britain and Ireland

Imperial Institute. Annual Report, 1938. By the Director, Sir Harry Lindsay, to the Board of Governors. Pp. 79. (London: Imperial Institute.) [301

University of Leeds: The Brotherton Collection. The Third Annual Report of the Brotherton Collection Committee. Pp. 4. (Leeds: The University.) [301

Scientific Proceedings of the Royal Dublin Society. Vol. 22 (N.S.), No. 6: The Constitution of Lamination; Isolation of 2:4:6-Trimethylglucopyranose. By Vincent C. Barry. Pp. 59–63. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) 1*s*. [301

A Road Policy for the Lake District. Pp. 36+4 plates. (Ambleside: Friends of the Lake District.) [301

Lord Hailey's African Survey. Surveyed for the Royal African Society by the Rt. Hon. Lord Harlech and a distinguished body of collaborators. Edited for the Society by F. H. Melland, and published as a Supplement to the Society's *Journal* for January. Pp. viii+70. (London: Macmillan and Co., Ltd.) 2*s*. net. [301

University of Leeds: Department of Coal Gas and Fuel Industries, with Metallurgy. Report of the Livesey Professor (John W. Cobb) for the Session 1937–8. Pp. 12. (Leeds: The University.) [301

Report of the First Imperial Veterinary Conference, 15th–19th August 1938. Pp. 97. (Weybridge: Imperial Bureau of Animal Health.) 5*s*. [311

Stonyhurst College Observatory. Results of Geophysical and Solar Observations, 1937; with Report and Notes of the Director, Rev. J. P. Rowland. Pp. xviii+40. (Blackburn: Stonyhurst College.) [12

Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences. No. 560, Vol. 229: The Geological History of the Lake Rudolf Basin, Kenya Colony. By Dr. V. E. Fuchs. Pp. 219–274+plates 26–32. (London: Cambridge University Press.) 15*s*. [62

Department of Scientific and Industrial Research. Report for the Year 1937–38. (Cmd. 5927.) Pp. iv+203. (London: H.M. Stationery Office.) 3*s*. net. [62

Other Countries

League of Nations. Bulletin of League of Nations Teaching. The Teaching of the Principles and Facts of International Co-operation. (No. 5.) Pp. 235. (Geneva: League of Nations; London: George Allen and Unwin, Ltd.) 2*s*. 6*d*. [301

Civil Aeronautics Authority: Planning and Development Division. Report No. 1: The Radiotelemeter and its Importance to Aviation. By R. W. Knight. Pp. ii+35+10 plates. (Washington, D.C.: Government Printing Office.) [301

Verhandelingen der Koninklijke Nederlandsche Akademie van Wetenschappen te Amsterdam, Afdeeling Natuurkunde. Sectie 2, Deel 37, No. 2: Die Scyphomedusen des Roten Meeres. Von G. Stiasny. Pp. iii+35+2 plates. Sectie 2, Deel 37, No. 7: Revision des Plexauriden Genus *Eunicella* Verrill (Versuch einer Synthese). Von G. Stiasny. Pp. 37+8 plates. (Amsterdam: N.V. Noord-Hollandsche Uitgevers-Maatschappij.) [301

University of Illinois: Engineering Experiment Station. Bulletin No. 305: Summer Cooling in the Warm-Air Heating Research Residence with Cold Water. By Prof. Alonzo P. Kratz, Prof. Seichi Konzo, Prof. Maurice K. Fahnestock and Edwin L. Broderick. Pp. 89. 90 cents. Bulletin No. 306: Investigation of Creep and Fracture of Lead and Lead Alloys for Cable Sheathing. By Prof. Herbert F. Moore, Bernard B. Betty and Curtis W. Dollins. Pp. 90. 1 dollar. (Urbana, Ill.: University of Illinois.) [311

Memoirs of the Indian Meteorological Department. Vol. 26, Part 9: Discussion of Results of Soundings of Temperature and Humidity at Jhikargacha (Bengal) in April and May 1929. By G. Chatterjee and N. K. Sur. Pp. 165–188+5 plates. (Delhi: Manager of Publications.) 1.8 rupees; 2*s*. 3*d*. [311

Expédition Antarctique Belge. Résultats du voyage de la *Belgica* en 1897–99. Rapports scientifiques. Zoologie—Mallophaga. By Gordon B. Thompson. Pp. 6+1 plate. (Bruxelles: Musée Royal d'Histoire Naturelle.) [311

Comité National français de Géodésie et Géophysique. Assemblée générale du 21 décembre 1937. Compte rendu publié par le Secrétaire général, G. Perrier. Pp. 137. (Paris: Secrétariat général du Comité français.) [12

Government of India: Meteorological Department. Magnetic, Meteorological, Atmospheric, Electric and Seismographic Observations made at the Government Observatories, Bombay and Alibag, in the Year 1936, under the direction of Dr. S. C. Roy and Dr. K. R. Ramanathan. Pp. xix+A76+B43+C4+D11+6 plates. (Delhi: Manager of Publications.) 11 rupees; 17*s*. 3*d*. [12

Report of the Secretary of the Smithsonian Institution and Financial Report of the Executive Committee of the Board of Regents for the Year ended June 30, 1938. (Publication 3489.) Pp. viii+117. (Washington, D.C.: Government Printing Office.) 15 cents. [12

Rensselaer Polytechnic Institute. Bulletin 55: The Value of History in Engineering Education. By H. W. Dickinson. Pp. 12. Bulletin 56: Amos Eaton as a Chemist. By H. S. Van Klooster. Pp. 20. (Troy, N.Y.: Rensselaer Polytechnic Institute.) [12

Catalogue of Foreign Books in the Tokyo Imperial University. Supplement 1: 1935–1936. Pp. vi+395. (Tokyo: Tokyo Imperial University.) [12

Imperial College of Agricultural Research. Miscellaneous Bulletin No. 25: The Nutritive Values of Indian Cattle Foods and the Feeding of Animals. By Dr. K. C. Sen. Pp. 39. (Delhi: Manager of Publications.) 7 annas; 8*d*. [62